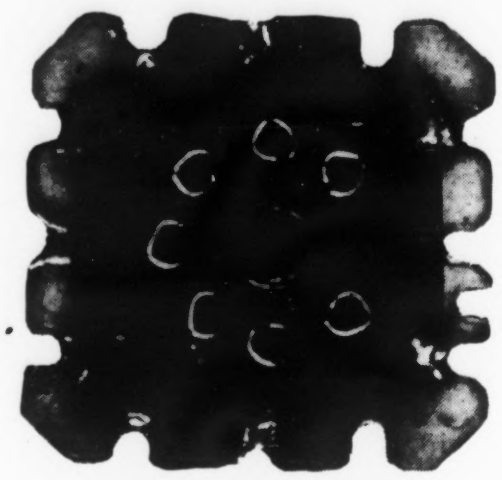
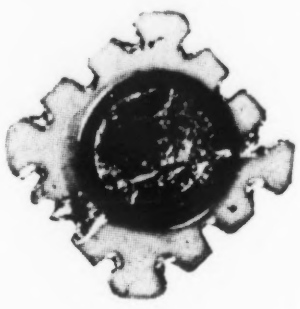
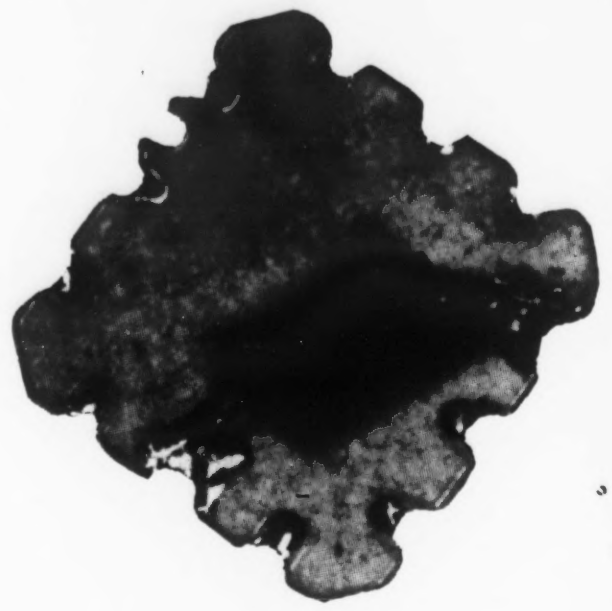
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Communications—Electronics—Photography

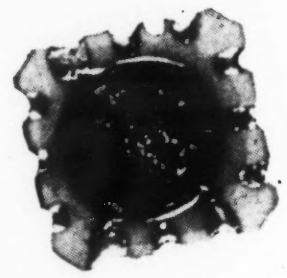
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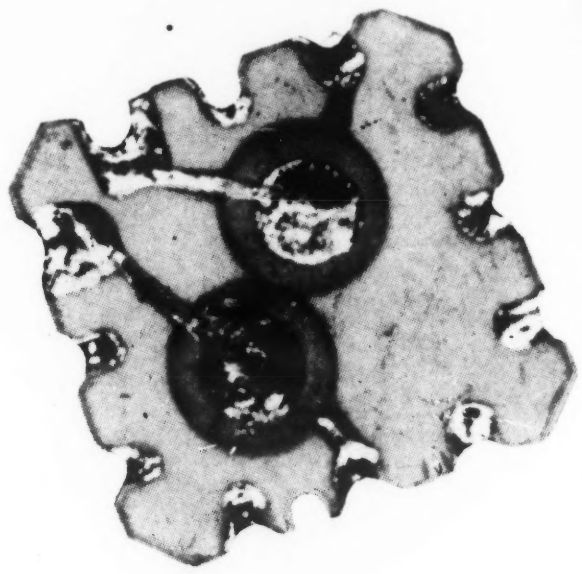


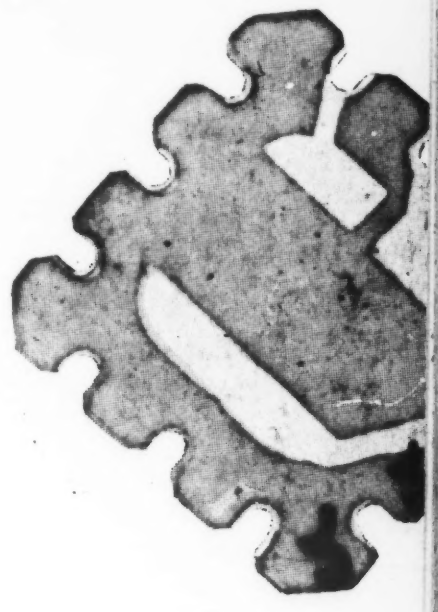




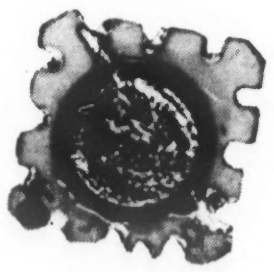












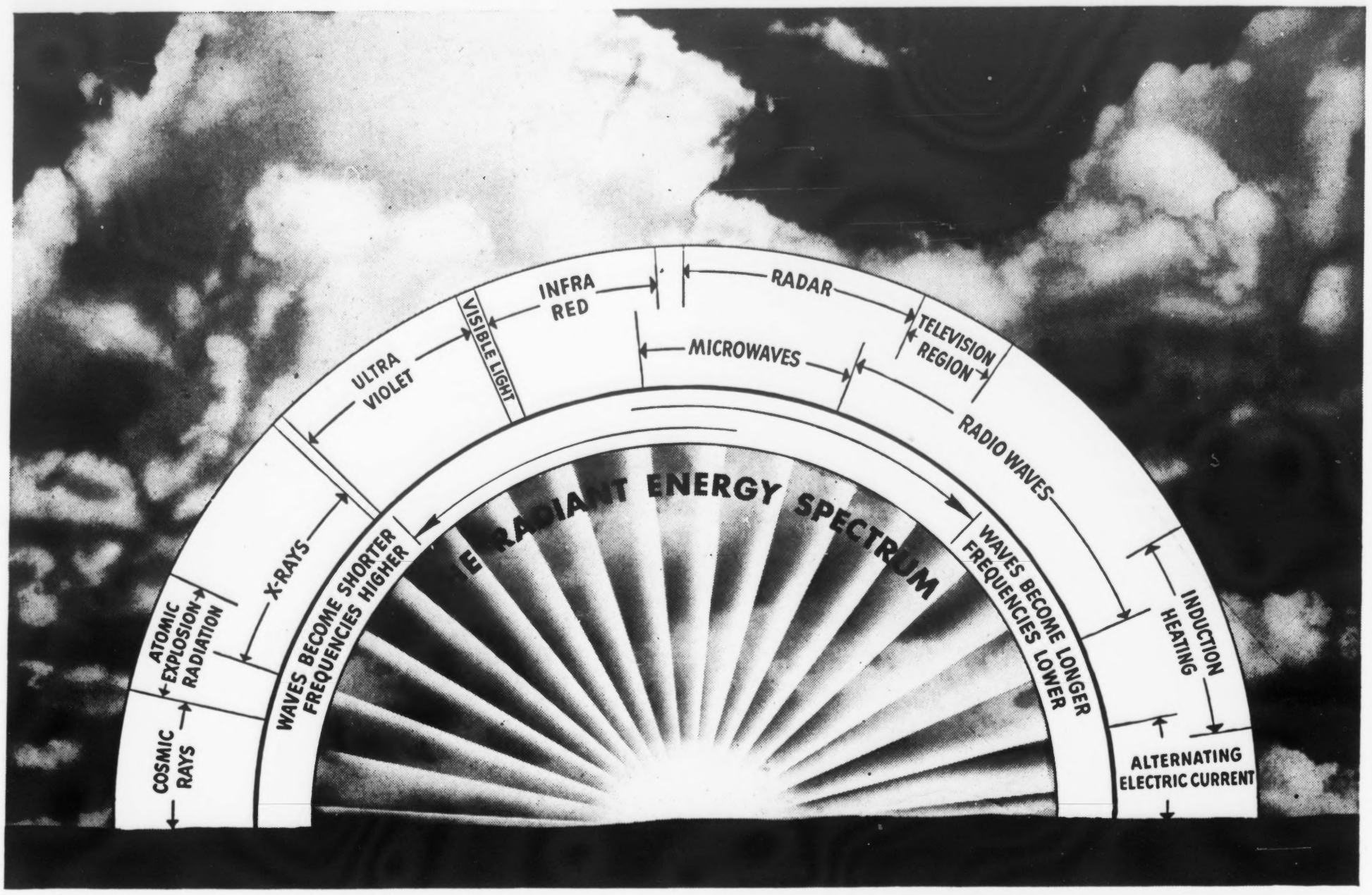
PROJECT TINKERTOY

Modular Design for Electronics

Modular Production for Electronics





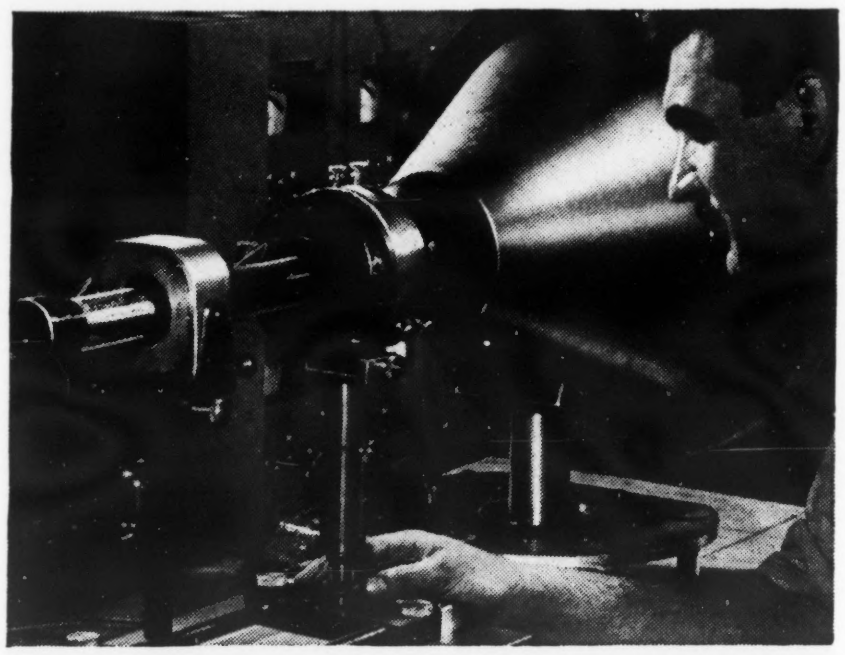


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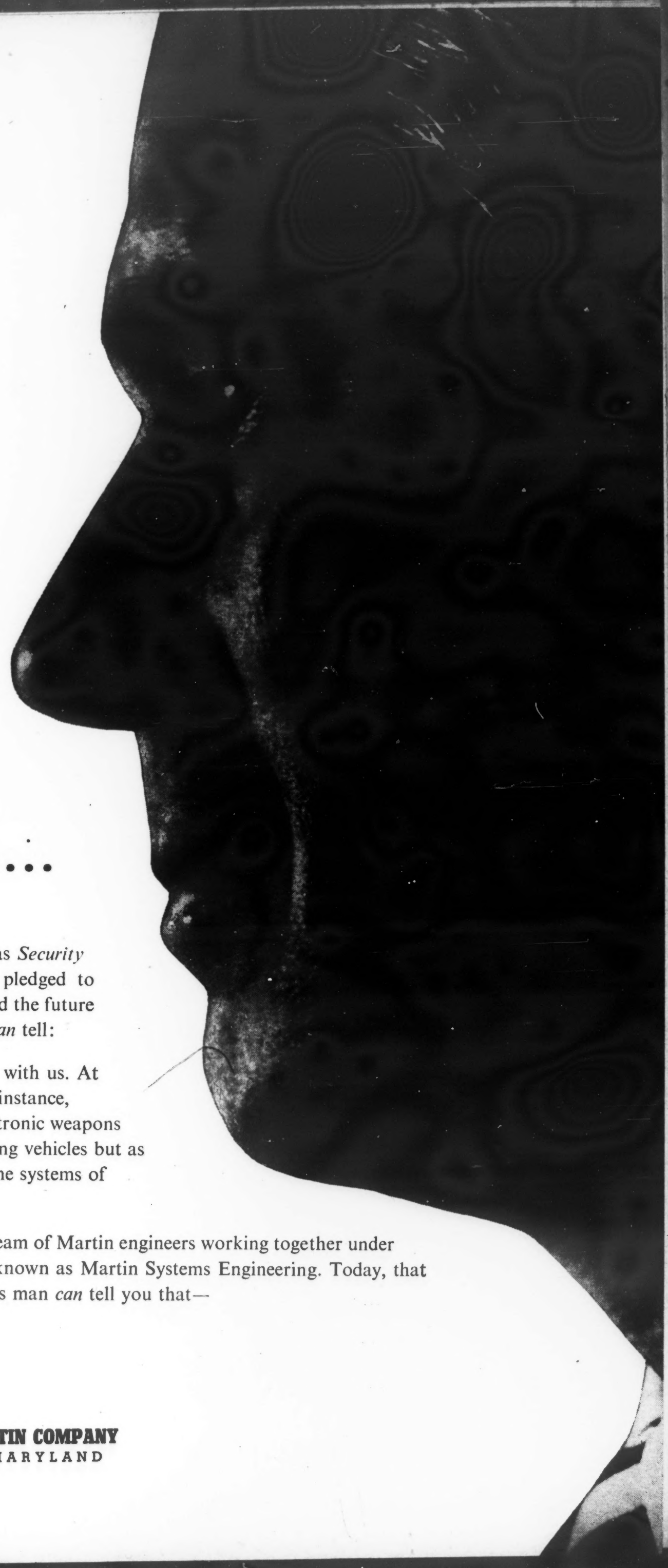
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If this man were free to speak...

Much of his thinking is classified as *Security Information*. Much of his mind is pledged to silence, for the love of his country and the future of our world . . . But this much he *can* tell:

Already the dawn of a new world is with us. At The Glenn L. Martin Company, for instance, new aircraft, guided missiles and electronic weapons are being designed not as today's flying vehicles but as coordinated and controlled spaceborne systems of tomorrow.

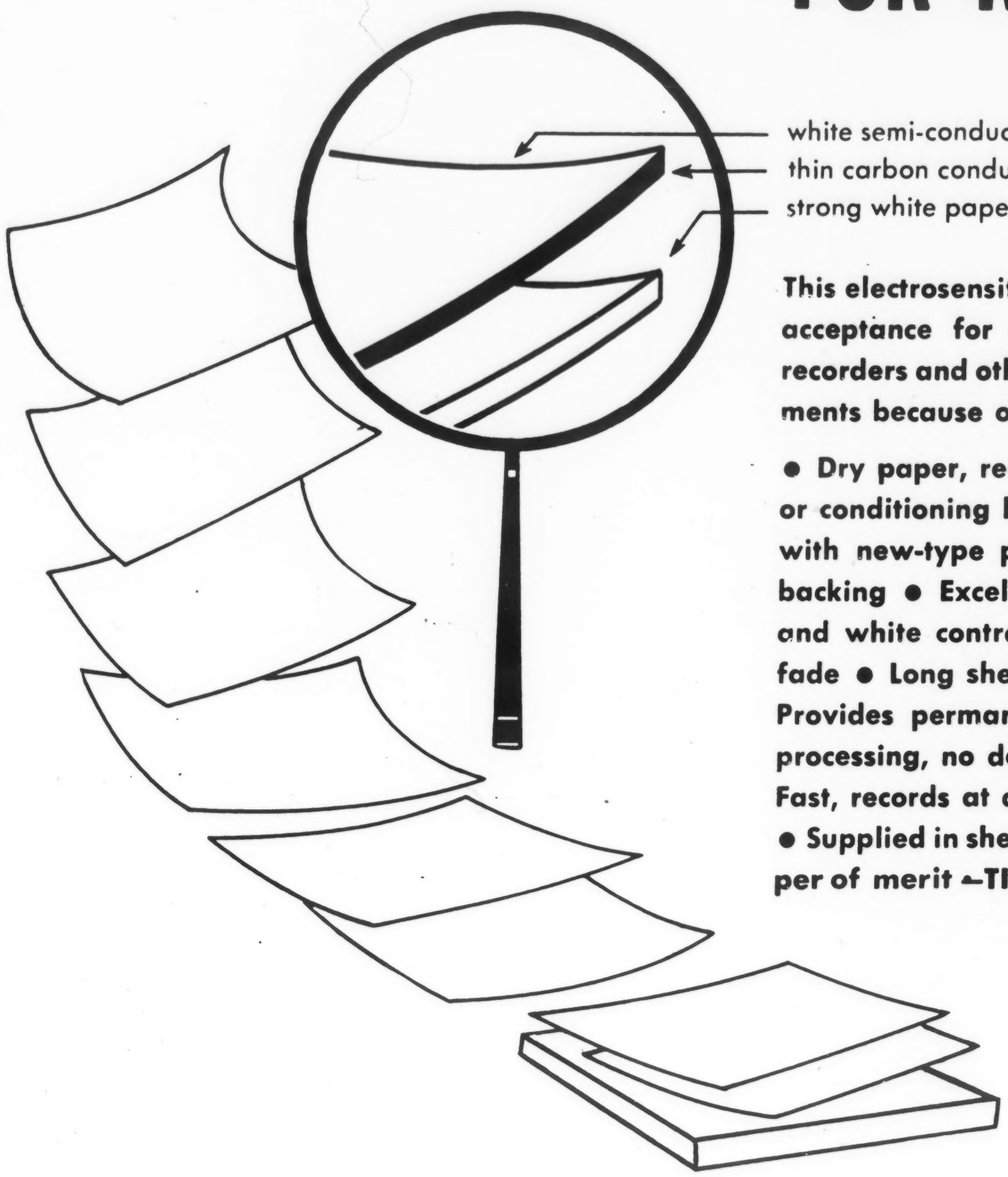
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Communications-Electronics-Photography

Journal of the Armed Forces Communications Association

VOLUME 8 NOVEMBER-DECEMBER 1953 NUMBER 2

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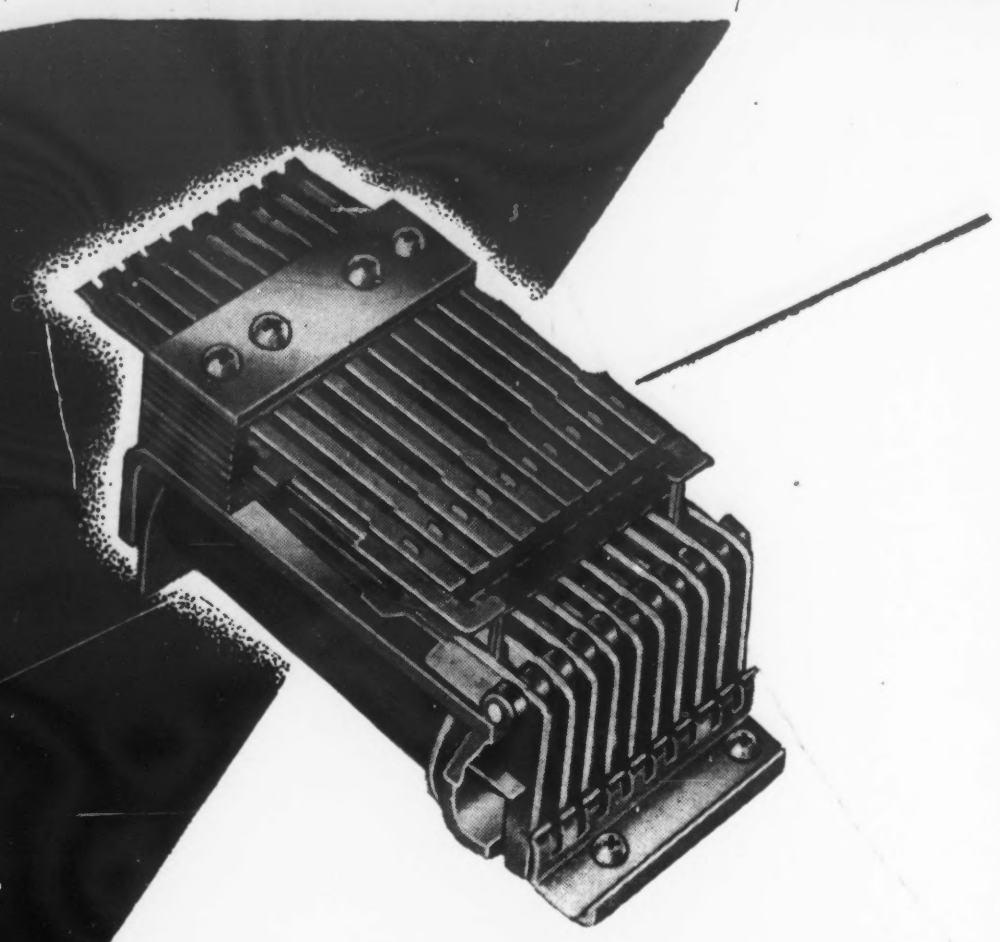
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SIGNAL is published bi-monthly by the Armed Forces Communications Association at 1624 Eye St., N. W., Washington 6, D. C. Entered as Second-class matter at Post Office, Washington, D. C., September 6, 1946, under Act of March 3, 1879. Additional entry at Baltimore, Md.

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KELLOGG

Magnetic Impulse Counter



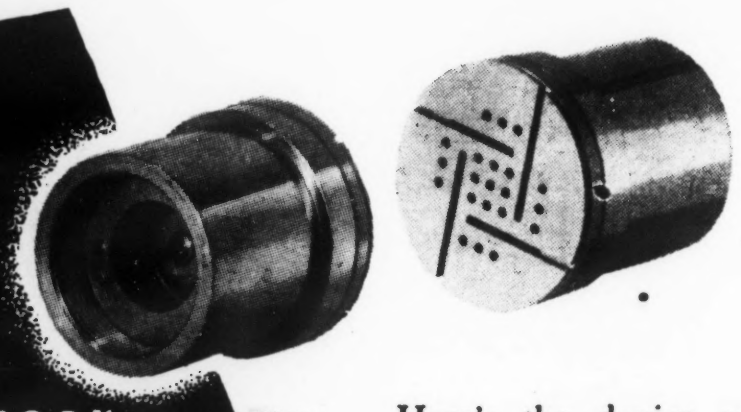
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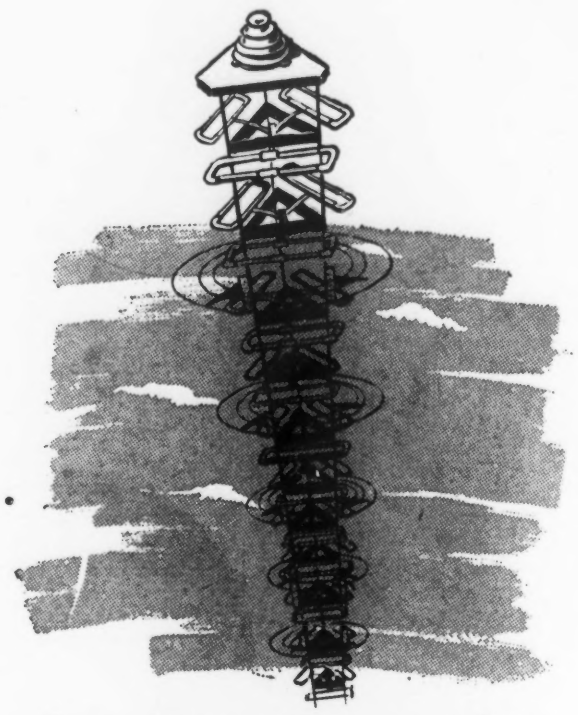
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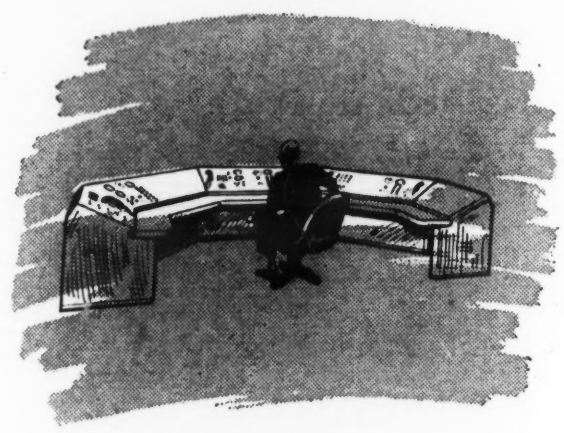
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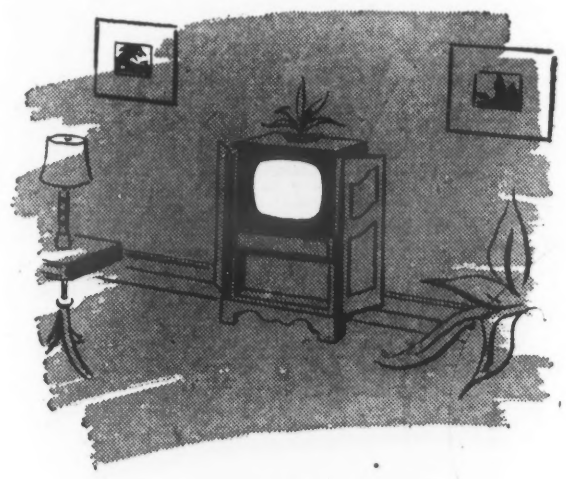
WITHIN THE NEXT DECADE television will grow beyond all present-day conceptions. International Telephone and Telegraph Corporation is ready to help speed the new industry on its way—ready with new transmitters of advanced design, improved studio equipment, high-gain antennas, microwave links for studio-to-transmitter and mobile pick-up—and ready with the finest instrument for home entertainment, the incomparable Capehart. Look to IT&T for tireless effort in television development.

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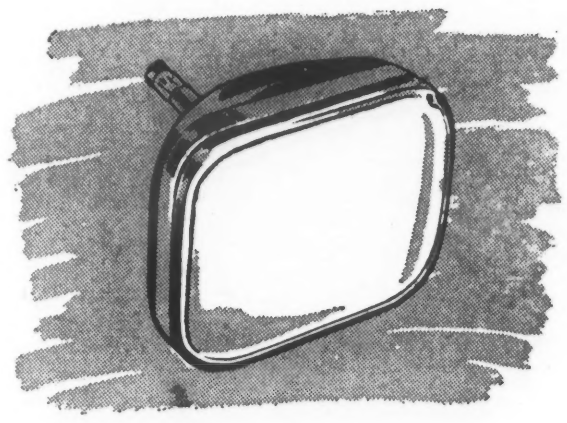
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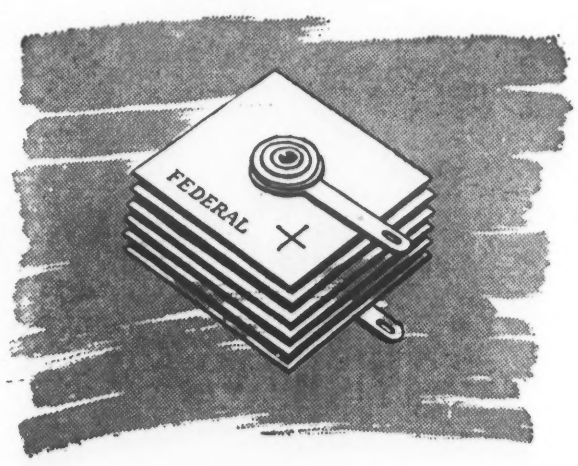
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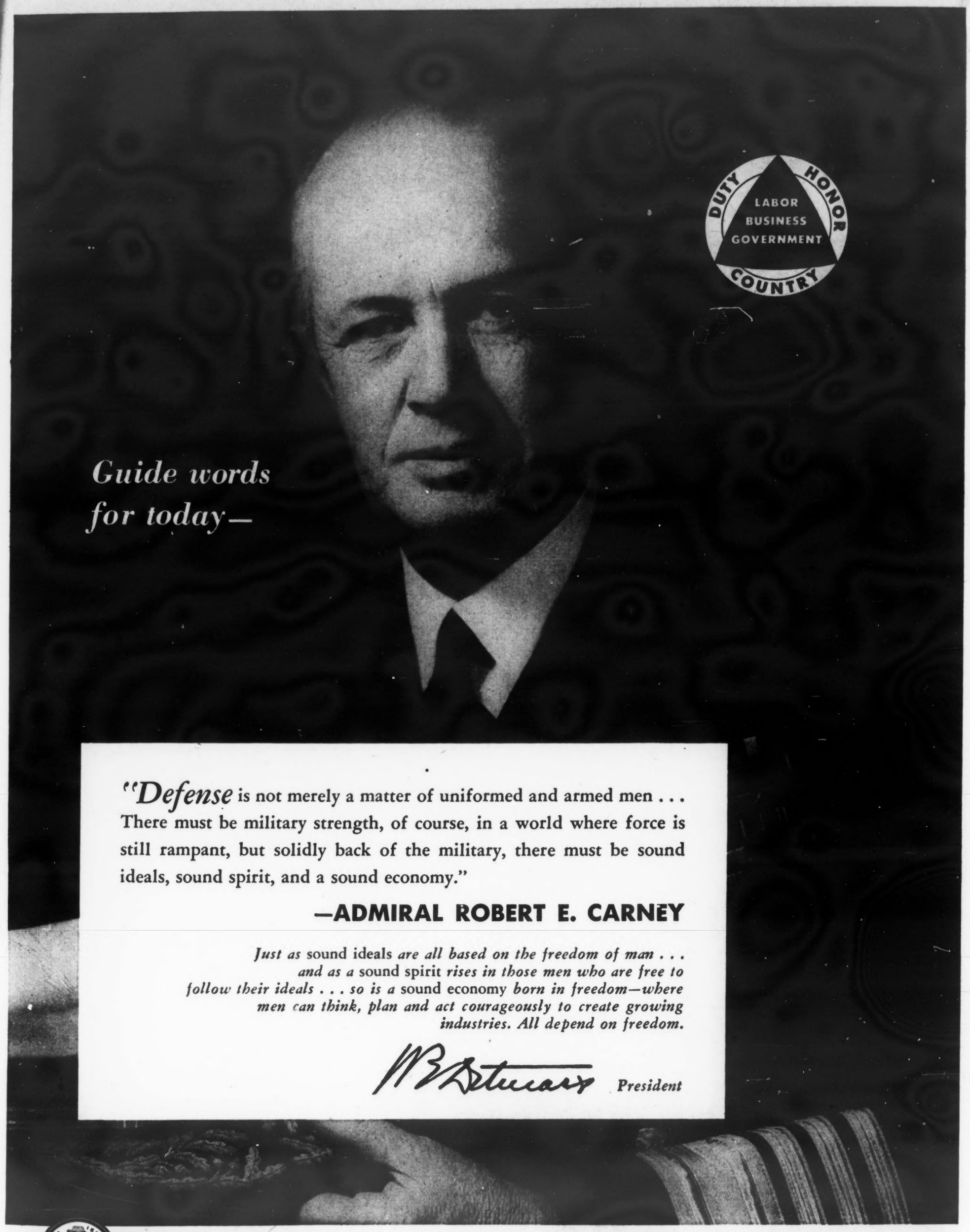
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ELECTRONIC HIGHWAYS FOR A GROWING NATION

LENKURT "STACKABLE" CARRIER EQUIPMENT PERMITS ORDERLY EXPANSION OF TELEPHONE SYSTEMS

A telephone carrier system that helps keep pace with the growth of America's communities and towns is one achievement of Lenkurt Electric, the nation's largest independent manufacturer of telephone carrier equipment. Just as one lane roads must grow to two lane and multi-lane highways, so telephone systems must grow to meet their traffic demands. Lenkurt was first to provide a practical and economical means for the expansion of telephone systems on a channel-at-a-time basis.

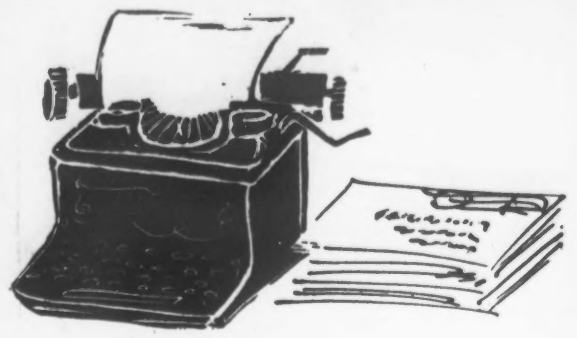
Lenkurt "stackable" carrier is an orderly "building-block" system that permits phone services to expand whatever amount is necessary — without buying more equipment than is needed or paying excessive premium for channel-at-a-time expansion. When two voice channels are needed in place of one, Lenkurt "stackable" carrier provides the one added channel — not three or twelve necessary with previous carrier systems. Then later if a second and third carrier channel are needed, these can be added one at a time.

Unlike previous systems suitable primarily for very long circuits, Lenkurt's "stackable" carrier is economical on the shorter toll circuits which comprise the bulk of all telephone networks.

Now used on thousands of telephone lines throughout the world, "stackable" carrier systems are one example of Lenkurt's contributions to the communications industry.

Lenkurt

LENKURT ELECTRIC CO.
SAN CARLOS 1, CALIFORNIA



Our Readers Write

Appreciation

Dear Sir:

Just want to take this opportunity to say many thanks for publishing my request for a copy of *Principles of Radio Communication* by J. H. Morecroft. I had several replies, one from an Air Force officer stationed in England! I received an excellent copy of the book.

SIGNAL is one of the most valuable technical publications to which I subscribe. Please maintain the present level of material, and the format.

FRANCIS S. DUNN (W8DTR)
Dayton, Ohio

(*Editor's Note: The columns of* SIGNAL *are open to the readers for similar searches and services.*)

Okinawa Correspondent

Dear Sir:

I received your bulletin, *The Doings at Dayton*, and was struck forcibly by the article and address by Mr. Frederick R. Lack. A very timely article indeed—and I took the liberty of reading this speech to my Signal Classes here in the 29th Inf. Regt. Communication people here in the Far East on all levels have been thinking along this line and now we see this association and its industrial and military members and leaders are at last reaching a common ground and will iron out these difficulties.

We in the field have found some of the ruggedness and dependability of the radio sets has been sacrificed to save weight. . . . Weekly problems — dirt, dampness, inexperienced operators—all take their toll rapidly, too rapidly.

SFC WILLARD L. POLSGROVE
29th Infantry Regiment

ROTC Award Winner

Dear Sir:

I feel that I have been highly honored and I am grateful indeed for the good fortune that has come to me.

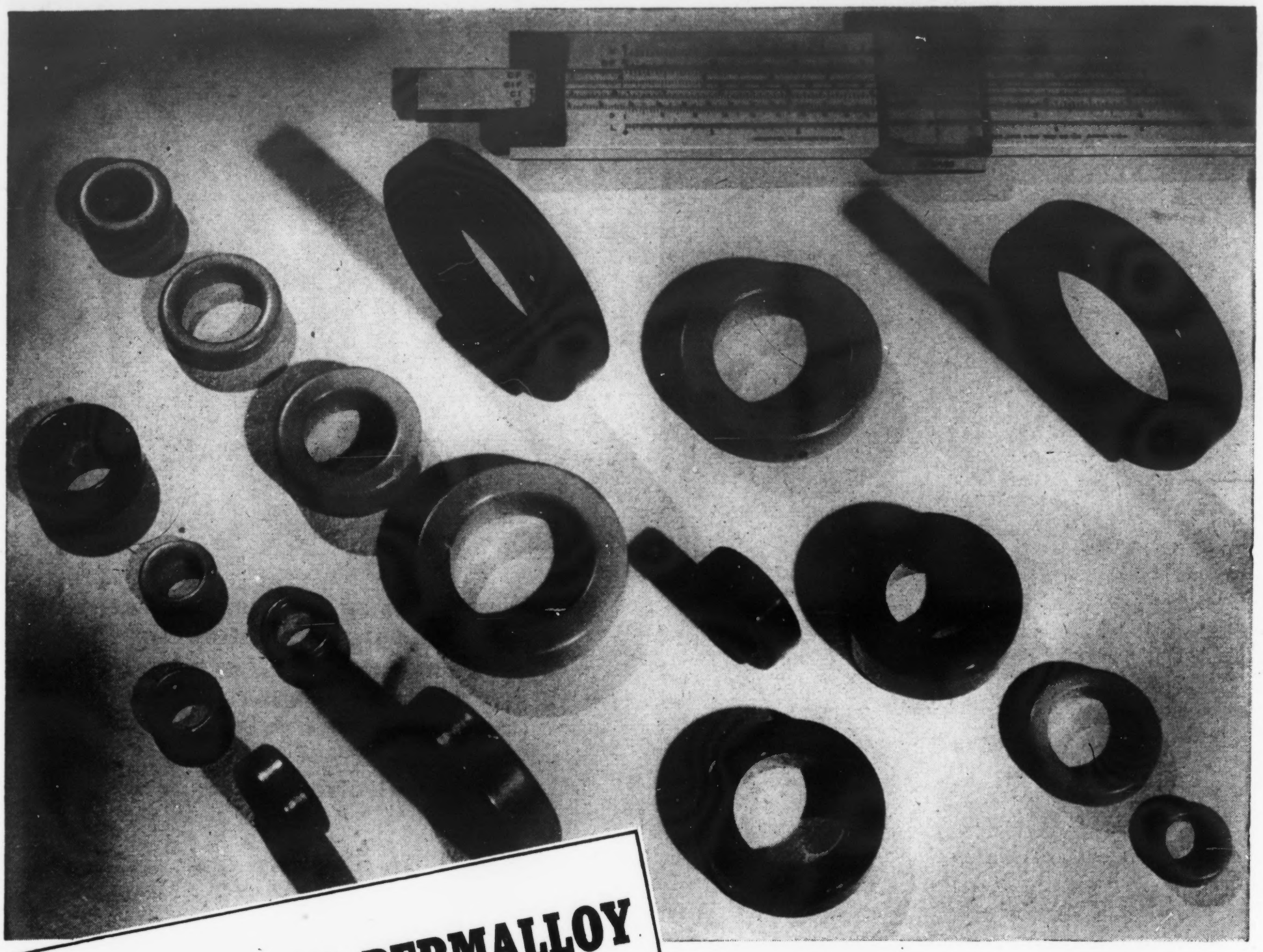
DOYLE C. COUNTS
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A Friend

Dear Sir:

I seize this opportunity to congratulate you warmly for the great strides which SIGNAL has accomplished.

DR. HENRY BURR
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*Manufactured under license arrangements with Western Electric Company

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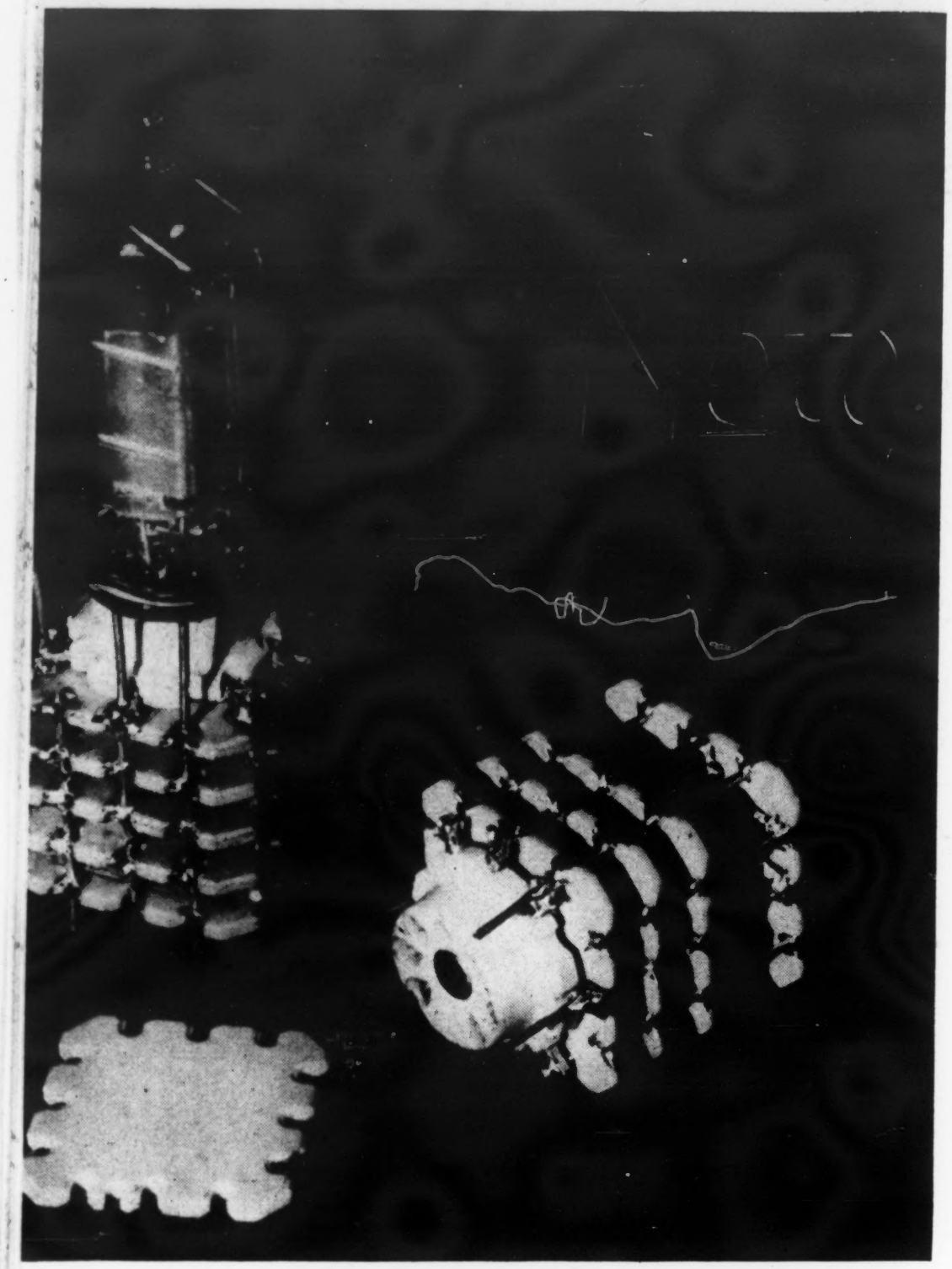
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Method for

Three years ago, Project Tinkertoy was begun and its completion has recently been announced. The announcement included photographs of the 7/8" modules, shown on our cover in actual and double size, and (left) a Tinkertoy-produced electronic instrument.

by Charles DeVore

AUTOMATIC, MECHANIZED production of electronic equipment for military or civilian use is now commercially feasible, thanks to *Project Tinkertoy*. Public announcement of this program was made recently (September) by the National Bureau of Standards and the Navy Bureau of Aeronautics to military planners and to representatives of the electronics industry.

Begun in May, 1950, Project Tinkertoy has successfully produced electronic assemblies by mechanized means. A pilot plant was constructed for the Navy by the National Bureau of Standards. After two and a half years of designing, building, and testing of the machinery, a complex submarine detection device, which is needed in large numbers in time of war, was selected for a sample test. Keeping to the same size and performance requirements, the new machine-made modules, or electronic building blocks, were substituted for the previous maze of wiring, resistors, capacitors, etc.

After a sample device passed the tests completely, a contract was awarded to an electronics production firm in order to determine whether they could be mass-produced. Delivery of the first detection devices on the initial order was made in mid-September, 1953, to the Bureau of Aeronautics.

Project Tinkertoy involved the development of two new systems: MDE, or Modular Design of Electronics; and MPE, or Mechanized Production of Electronics. Instead of conventional parts—such as resistors, capacitors, and wires, assembled and soldered by hand—adhesive-tape resistors, thin ceramic capacitors, conducting paints for wires, and automatic dip soldering are used.

MDE makes use of mechanically standardized and uniform modules, or building blocks, each consisting of some four to six thin ceramic wafers about the size of a postage stamp and bearing various circuits associated with an electronic stage. By combining individual modules to form a major subassembly, whole electronic circuits may be developed to amplify signals, generate and shape wave forms, scale count, and perform other customary electronic functions.

MPE consists in the mechanized production of ceramic wafers, titanate capacitors, and tape resistors, and their automatic mechanical assembly and testing. The assembly process includes the moutning of tube sockets on wafers (electron tubes are *not* produced in this system) and such operations as soldering and tinning, accomplished automatically through the use of such methods as induction heating and dip tinning. Provision is made for 100-percent automatic in-

Electronics Production

spection during each stage of MPE, including both physical gaging and an electronic comparison. After the final assembly of the module the whole circuit is again tested to see that it meets specifications within set tolerances.

Normally, a set of modules (sometimes as many as ten) are mounted on or between copper-clad base plates. Circuits have been etched into the copper surface and connect the riser wires (which serve both as structural supports and electrical conductors) of the modules to form a complete electronic circuit. Several such plate assemblies may form an equipment. One base plate with six modules, for example, contains all the necessary circuits to make a six-tube radio receiver function properly.

Project Tinkertoy was based on concepts and techniques developed largely by the National Bureau of Standards. It was sponsored by the Navy Bureau of Aeronautics as an industrial preparedness measure, aimed at the establishment of facilities or systems suitable for rapid mobilization in emergency periods.

One of the serious bottlenecks in such periods has turned out to be the production of electronic equipment, upon which the military services are increasingly dependent for success in modern warfare. According to RETMA's president, deliveries of electronic equipment and components to the military in 1953 are expected to exceed $3 billion.

A major problem confronting military planners has been the possibility of shortage of parts and the delay—largely related to lack of trained production personnel in peak production periods brought on by emergencies—between military orders and the installation of finished electronic equipment. Project Tinkertoy indicates that the problem of parts (such as resistors and capacitors) can be solved through the direct use of raw materials and that lead time can be reduced by 75 percent.



Interior view of the Project Tinkertoy plant. The machine in the right foreground is the module assembler. For the production of MPE equipment, the present machines manufacture ceramics, process and apply piece parts to wafers, assemble modules, and automatically perform complete inspections.

The preformance of equipment produced during this program appears generally eqivalent to that obtainable from conventional assemblies. Equipments produced on an experimental basis meet military environmental requirements, passing such tests as shock, vibration, temperature, and humidity established in military specifications. The system also appears to offer decided advantages in terms of reliability and ruggedness of equipment, and should simplify field maintenance problems by permitting the replacement of complete modules or assemblies instead of individual resistors and capacitors. Recent estimates of the ratio of cost of maintenance to cost of production have ranged all the way from 10 to 1 to 100 to 1.

The dual-purpose nature of the new production system is an advantage to industry as well as to the military planners. A wide variety of types of

civilian or military equipment can be produced on the same machines and the ratio of such mixed outputs can be readily varied. According to the National Bureau of Standards, the output of the system can be readily altered—within 24 hours—in accordance with changes in design or equipment, and the system can be maintained in a stand-by condition, if need be, ready for prompt utilization. The developers also point out that it is not necessary to set up a plant capable of manufacturing complete assemblies; the techniques are adaptable to the manufacture of individual bits and pieces, such as resistors and capacitors.



Before and After MPE—The unit at the left was assembled by conventional techniques using conventional electronic parts. The unit on the right was mechanically produced by the Project Tinkertoy method.

The new method of production grew out of a search by the Navy Bureau of Aeronautics for a means to break the electronics bottleneck which posed a serious logistics problem in World War II and again at the beginning of the Korean conflict. For a solution to this problem, the Navy turned to the National Bureau of Standards, which had done pioneering work in printed electronic circuits, stemming from problems arising in its proximity fuze work during World War II. By 1950, the Bureau had developed a modular design concept, tape resistors, special circuit printing techniques, and hand-machines for printed circuits. Problems of miniaturization and ruggedization of electronic equipment had also been under study for some time. The first modular design of military electronic equipment had been completed by NBS in 1949, when a radar i-f assembly had been designed and constructed.

From June, 1950, through June, 1953, funds totaling approximately $4,700,000 were allocated by the Navy to the National Standards for Project Tinkertoy. The bulk of these funds—85 percent—were expended in the procurement of equipment from industry (largely through subcontracts).

The final design and subsequent construction of many Project Tinkertoy machines called for the services and assistance of industry at a time when the Korean emergency had preempted most machine-tool and related facilities. The Navy and the National Bureau of Standards, however, were able to secure the cooperation of several companies with available facilities and staff.

In place of the conventional wiring diagram, the MDE system places all necessary production programming information on an MDE work sheet. Each work sheet contains the front and back outlines of six wafers with appropriate numbering to identify each notch in the wafer, each riser wire, and the electronic piece that is to be placed on the wafer. The engineer translates his conventional wiring diagram to an MDE diagram. He indicates the position of the piece and its proper value and tolerances. Lines are drawn to indicate how the circuits between wafers are to be connected.

The engineer's MDE work sheet becomes the basic document from which a draftsman draws an ink drawing that may be reproduced in large numbers. The draftsman also prepares a larger version of the work sheet that is photographed and is subsequently used to make stencils for the circuit printing machines. The numbers of wafers and tube sockets listed on the MDE work sheets give an indication of the quantity of raw ceramic materials that must be mixed. The number and value of resistors marked on the work sheets determine the production required for tape resistors.

The MDE work sheet is also used to establish the inspection procedure. Current paths on each wafer are marked on specially prepared punch cards. These cards accompany the wafers through all the manufacturing processes. The sheet is also used in the construction of the standard modules or counterparts that are employed in the final testing and inspection of the module assembly.

The wafers and tube sockets are made from a controlled combination of talc, kaolin, and barium carbonate.

In the module assembler, parts-mounted wafers are loaded in vibratory bowl feeders that issue single, oriented wafers into a stacking jig. Simultaneous soldering operations bond riser wires to the wafer notches.



The three minerals are mixed, filtered, and dried to a flour. The flour mixture is further refined and then loaded into a mechanical device which stamps out the wafers and tube sockets and cuts the riser wire notches. The press can produce about 2800 pieces per hour. From the press the wafers are sent through a tunnel kiln, operating at 2300° F, which cures the ceramic in nine hours. After curing, the wafers are mechanically gaged, and all pieces which do not fit within close tolerances are rejected.

The titanate capacitor body is manufactured in Project Tinkertoy in very much the same manner as the ceramic wafers. The capacitor is nonporous ceramic composed of mag-



Quality control and 100-percent automatic inspection are provided by machines such as this pattern tester. Punched cards set up appropriate test circuits in the electronic inspection devices.

nesium, barium, calcium, and strontium titanates of high purity. It is about ½ inch square and 2/100 inch thick. The capacity values vary from 7.0 micromicrofarads to 0.01 microfarad. Raw material batches weighing about five pounds will produce about 100,000 capacitors, about 80 percent of them acceptable.

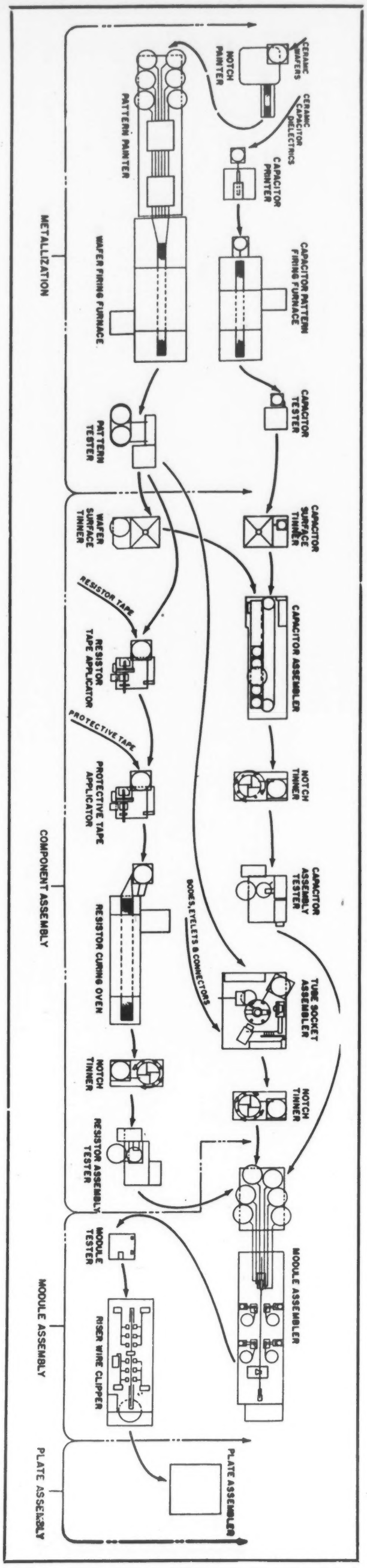
The materials required for manufacture of tape resistors in Project Tinkertoy are a heat-resistant asbestos paper tape known as Quinterra, polyethylene tape, carbon black or graphite, resin, and a solvent. The resistor formulation, consisting of a mixture of the carbon, resin, and solvent, is ground to a very fine adhesive powder. The compound is then sprayed on a loop of Quinterra tape. Immediately after the compound is sprayed on, a protective coating of polyethylene tape is applied over the resistor compound. The tape is slit into five or six narrow strips and stored on rolls in a refrigerator. A 75-foot roll of tape will produce over 10,000 resistors. The tape resistors produced have a range from 10 ohms to 10 megohms. They will hold their rated resistance within ± 10 percent up to temperatures near 400° F and are capable of ¼-watt power dissipation at the operating temperature.

Metallizing is the name given to a series of operations in the Project Tinkertoy plant in which appropriate sections of the wafer or capacitor body are silver-painted. During these stages, circuits are printed on the wafers, the notches are coated, the conducting surfaces and leads are applied to capacitors, the bodies are cured in a furnace, and the circuits are inspected. All of the operations are mechanized.

Once the wafers and components have been made and metallized, the next step is their joining. Machines are used to apply up to two capacitors to each side of a wafer. Other machines apply either one or two resistors to each side of a wafer. Rolls of resistor tape are mounted on a machine that automatically cuts the tape into ½-inch strips, presses the tape between printed electrodes on a wafer, applies pressure, and ejects the completed piece. Tube sockets are also mounted on their appropriate wafers so that the pins will connect with the suitable notches.

After many of the steps in the components assembly process, operations such as soldering and tinning must be performed. These are accomplished automatically by utilizing such methods as induction heating and dip tinning.

Uniform wafer-mounted component parts, including wafer-mounted coils, toroids, potentiometers, and crystals are now ready for assembly. The complete assembly of the module is accomplished in a single machine. Six vibratory feeders issue the wafers to a loading device that holds the wafers in an upright position between specially designed jaws. A chain drive carries the jig to a soldering position at which six riser wires are guided into appropriate notches, three on a side. The mechanism brings soldering irons in contact with the unit and bonds the wires to the notches. A mechanism next turns the unit 90 degrees, and the chain drive carries it to another soldering position where six more wires are bonded to the module. The final operations on an assembled module consist of automatically clipping the riser wires at specified positions and testing the completed units.



Mechanized production line of the National Bureau of Standards pilot plant at Arlington, Va. With 20-odd machines, this plant is designed for an output of 1,000 modules an hour.



The eleven units of the "701" as they are installed in IBM World Headquarters in New York.

The "701", IBM's newest electronic calculator, serves government and industry with phenomenal accuracy and speed.

LAST MARCH, A NEW ELECTRONIC calculator was announced by the International Business Machines Corporation. Designed to shatter the time barrier confronting technicians working on vital defense projects, the "701" is manufactured in IBM's Poughkeepsie, N. Y. plant where production-line techniques of assembly and standardization are used.

Composed of eleven compact and connected units known as IBM Electronic Data Processing Machines, the 701 is the first calculator of comparable capacity to be produced in quantity. A total of eighteen are on order for the first year, all consigned to government agencies or defense industries.

The calculators, which rent for $11,900 monthly or more, depending upon storage capacity, are used for the calculation of radiation effects in atomic energy; for aerodynamic computations for planes and guided missiles, including vibration and stress analysis, design and peformance computations for jet and rocket engines, propellers, landing gear, radomes, etc.; on studies related to the effectiveness of various weapons, and on steam and gas turbine design calculations. A company which has pioneered the use of high-speed digital computers for cost accounting with the IBM Card-Programmed Electronic Calculator uses the 701 to speed and simplify the immense task of assembling and interpreting production cost data from its several plants. In government agencies the 701 is used principally on classified problems.

The 701 installed at IBM World Headquarters in New York is operated as a Technical Computing Bureau for organizations having problems involving mathematical computations. These include problems similar to those listed above, as well as geophysical calculations and commercial studies. Test computations now in progress include a problem relating to the electronic charge distribution in the nitrogen molecule.

In preparation for the use of this machine by American industry, a staff of IBM scientists was engaged for two years in planning the economical solution of typical problems. One result of this work is that users of the machine need no longer be concerned with tracing the position of the decimal point through problems involving thousands of millions of sequential arithmetical steps. Using a "floating point" technique the machine notes the position of the decimal point in the input numbers, keeps track of the point, and finally reports the position of the decimal point as the results are printed.

So much progress has been made in ease of use of electronic computers that in a course of only three weeks duration, IBM is able to instruct its Technical Computing Bureau users in the preparation of problems for the 701 and operation of the machine.

The 701 uses all three of the most advanced electronic storage, or "memory," devices — cathode ray tubes, magnetic drums and magnetic tapes. The computing unit uses small versions of the familiar electronic tubes, which are able to count at millions of pulses a second. In addition, several thousand germanium diodes are used in place of vacuum tubes, with resultant savings in space and power requirements.

The 701 was designed for scientific and research purposes, and similar components are adaptable to the requirements of accounting and record-keeping. Research on commercial data processing machines is under way.

The 701 is capable of performing

more than 16,000 addition or subtraction operations a second, and more than 2,000 multiplication or division operations a second. In solving a typical problem, the 701 performs an average of 14,000 mathematical operations a second.

Internally, the 701 performs operations in the binary number system. All initial data and final results may be in the familiar decimal number system. High-speed conversion between number systems is handled automatically by the calculator.

But speed alone is not enough. To be able to solve the problems of enormous mathematical complexity attending the defense effort, a computer must also have prodigious storage capacity and extreme flexibility. Further, it must have input and output systems that are both fast and efficient.

When the outbreak of hostilities in Korea made the production of devices embodying all these components imperative, IBM was ready with the necessary prototypes. Its years of research and development in the field of computing already had produced the Automatic Sequence Controlled Calculator, first of the so-called "giant" brains, and the Selective Sequence Electronic Calculators and Card-Programmed Electronic Calculators for business and industrial use.



Magnetic tapes in the new Electronic Data Processing Machine can introduce or record data at the rate of 12,500 digits a second and have a capacity in excess of 2,000,000 digits a tape. Each of the two Magnetic Tape Readers and Recorders handles two reels of tape simultaneously.

The Korean emergency clearly defined the need for a calculator that would take a front-line position in the preparedness program—one capable of solving hitherto insurmountable engineering and scientific computing problems and eliminating many costly and time-consuming trial and error methods while helping to relieve the shortage of technically trained personnel.

The new computer can solve problems involving partial differential equations, ordinary differential equations, integral equations, matrices and combinatorial analyses. Partial differential equations occur, for example, in calculating the rate of flow of heat in the skin of a supersonic missile; ordinary differential equations arise in calculating the expected flight characteristics of the missiles; integral equations arise in calculating radiation intensities; matrices arise in component analyses in petroleum products, and combinatorial analyses arise in strategic and tactical considerations.

The need for an electronic machine which will carry out thousands of operations a second is illustrated by the fact that the solution of a well-known partial differential equation useful in aircraft wing design requires 8,000,000 calculating steps per case.

The solution must be carried out step by step. Thus step 100 cannot be computed until the result of step 99 is known. Consequently, only one man, working with pencil and paper or one machine, can be occupied with the problem at any one time. *The 701 completes the solution in a few minutes.* A man working with

The two drums in the Magnetic Drum Storage Unit will store more than 80,000 digits. Data may be stored on a drum or obtained from it in an average of 40/1,000 of a second. The "reading" and "writing" heads, approximately 1/1,000 of an inch from the surface of each drum, read and write magnetized spots of data while the drum spins at approximately 2,929 revolutions a minute.



a desk computer and using the same method would require seven years!

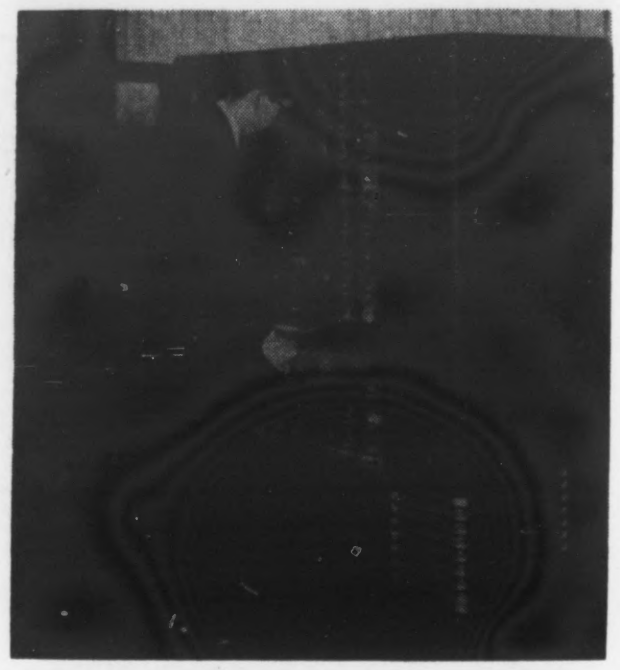
The banks of cathode ray tubes in the 701, known technically as electrostatic storage units, comprise the heart of the machine through which all information to and from all other components must pass.

The tubes, each resembling a smaller version of the picture tube used in television sets, can store the equivalent of 20,000 decimal digits on their screens by means of the presence or absence of charged spots. In a few millionths of a second, any digit stored on a tube screen can be selected for use, with a scanning electronic beam "reading" the charges and converting them into electronic pulses. These pulses are interpeted as numbers or calculating instructions.

The computer's magnetic drums—swiftly spinning cylinders surfaced with a material which can be easily magnetized—can store the equivalent of 80,000 decimal digits, any of which are available for use thousands of times a minute.

The magnetic tapes used in the 701 are similar in appearance to those employed by home sound recorders. In the new computer, each reel of tape can store 2,000,000 digits. Since fresh tapes can readily be substited for those "filled" with digits, magnetic tape storage in the 701 is unlimited, for all practical purposes.

Components of the 701 include an Electrostatic Storage Unit, a Punched Card Reader, an Alphabetical Printer,



The banks of cathode ray tubes are known technically as electrostatic storage units and comprise the heart of the machine through which all information to and from other components must pass.

a Punched Card Recorder, two Magnetic Tape Readers and Recorders, (each including two magnetic tapes), a Magnetic Drum Reader and Recorder, and units governing power supply and distribution.

A typical problem is handled by the 701 in this fashion:

All pertinent numbers, representing both the digits to be processed and instructions as to the procedure to be followed, are fed into the computer and automatically transmitted to the Electrostatic Storage Units.

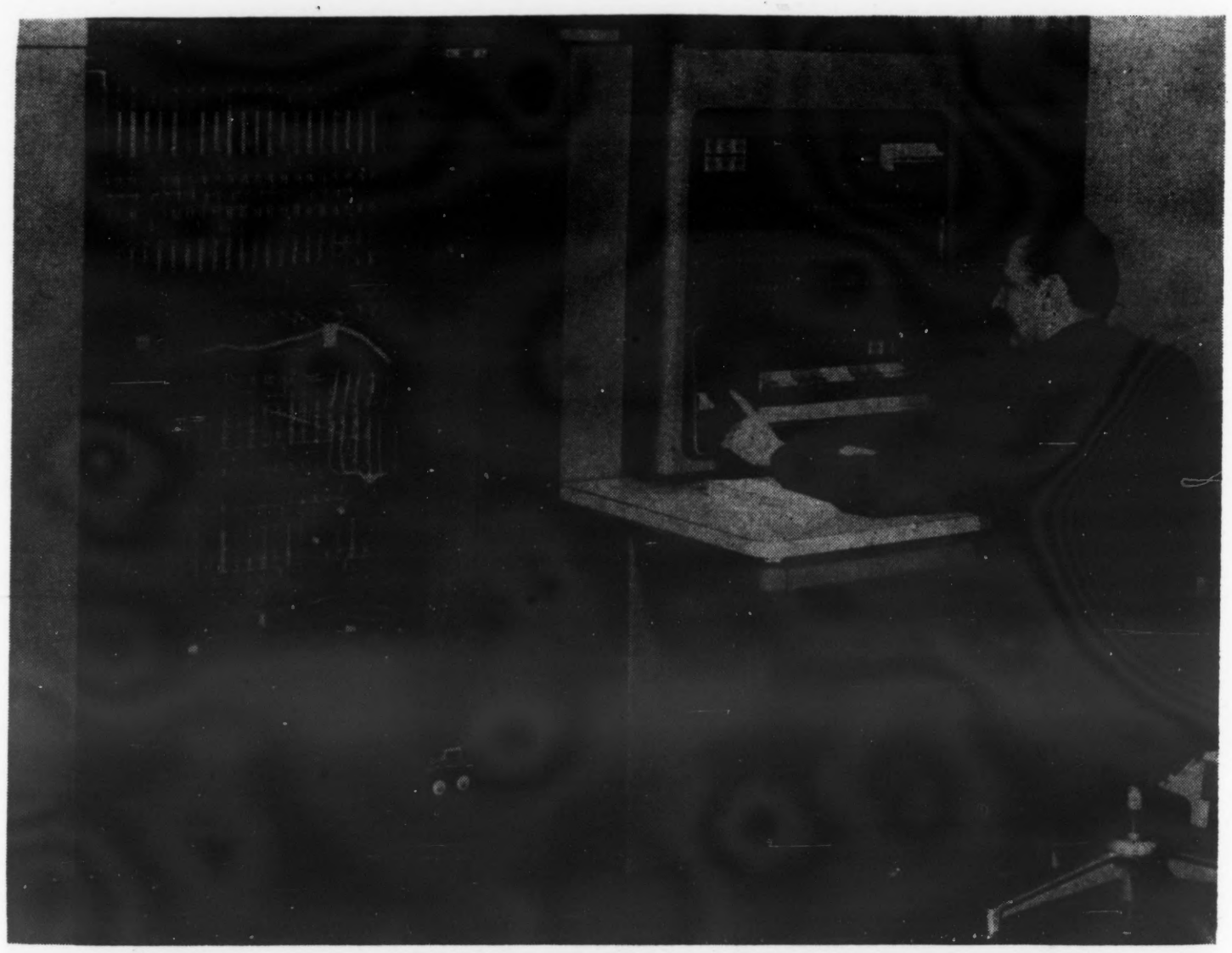
The instant the machine has the data necessary to solve the problem, it begins computing. This is done by the arithmetic and control circuits of the Analytical Control Unit, which take numbers from the Electrostatic Storage Units according to instructions and perform any combination of arithmetic operations desired.

By means of the instructions provided the machine prior to the start of computing operations, the control circuits will make decisions as to the steps required to complete the solution of the problem without intercession by the operator.

When the computing is completed, step by step, the results are stored back in the Electrostatic Storage Units. If so directed in the preliminary instructions, the machine will then print the results by means of a 150-line-a-minute printer at the rate of 1,050 ten-digit numbers a minute. For compact storage and high speed input and output, the 701 will transmit results to magnetic tapes at a rate equivalent to 1,250 ten-digit numbers a second. Also, if desired, the machine will punch the results in standard punched cards at a rate equivalent to 2,400 ten-digit number a minute.

In the case of problems involving more digits than can be conveniently stored in the Electrostatic Storage Units, the figures and calculating instructions are stored on the magnetic drums and tapes. When these are needed for use by the arithmetic circuits, they are automatically transmitted to the electrostatic memory components and the operation proceeds as outlined above.

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The IBM Electronic Data Processing Machines, though primarily controlled by an internally stored program of instructions, are under the direct supervision of one operator. From this control center, the operator can, when required, easily change the course of a problem. Indicator lights on the panel enable the operator to determine at a glance the exact phase of the work being processed and to observe what number is stored in any location of the electrostatic storage unit. The operator's panel is a part of the Electronic Analytical Control Unit, pictured here, the center for all computing and control in the "701." The arithmetic and control circuits of the control unit take numbers from the electrostatic storage units according to instructions and perform any combination of arithmetic operations desired. By means of the instructions given the machine prior to the start of computing operations, the control circuits will make decisions as to the steps required to complete a problem without intercession by the operator. The computing and control section of this unit is open, revealing part of its intricate wiring.

On Radio Communication and Field Ingenuity

More about "Obstacle Gain" — the GI's answer to mountains and valleys in Korea.

by
Raymond E. Lacy
Signal Corps Engineering Laboratories

HERE'S A STORY WORTH TELLING. It is about radio communication via an obstacle!

Credit for the discovery belongs entirely to the American service man who has again proven his ability to do the impossible. And more important he's been putting his discovery to use for some two years.

The propagation scientists are now busy rediscovering it. The information will soon echo from the professional podiums from coast to coast.

The situation arose during the winter of 1952-53 when my boss informed me that Major General J. D. O'Connell, Deputy Chief Signal Officer, had directed propagation specialists of the Signal Corps to find out why the G.I.'s were doing the impossible with AN/TRC-1 radio relay sets in Korea and Alaska. The reaction was something to the effect that if it was impossible, why bother; besides we had our hands full with other major work in the laboratory.

In addition to General O'Connell, another General was asserting that the AN/TRCs were a lot more useful than the "States-Side" people knew—and the "States-Side" people did know the AN/TRCs were useful, to put it modestly. In fact this gentleman, Brigadier General W. T. Guest, Commandant of the Fort Monmouth Signal School, was giving personal lectures at the Fort Monmouth school telling them how to engineer AN/TRC installations. He had recently returned from duty as Signal Officer of the Eighth United States Army, Korea. and knew the score.

Well, the ordered expedition is over now, and it proved to be one of the most worthwhile expeditions the Signal Corps has ordained.

We decided to take the trip like bad medicine and get it over with. So we surveyed the situation from our "ivory tower" (from which we could not see Korea or Alaska), and cooked up a plausible scientific reason (if only to soothe our wounded vanity) for the coming "experiment." We initially reasoned that if the Army was supposedly getting radio relay communication over paths that were impossible, then intermittent communication must be acceptable. So we would proudly return with the statistics showing that our Army was accepting less than the best! It turned out we were wrong.

Mr. F. H. Dickson, propagation expert of the Office of the Chief Signal Officer, had been assigned as project leader, and invitations had been issued to large organizations prominent in radio propagation to supply propagation specialists. The RCA Laboratories of the Radio Corporation of America very graciously provided the services of Mr. Gilbert S. Wickizer, and the Central Radio Propagation Laboratories of the National Bureau of Standards sent their very able Mr. John W. Herbstreit. Mr. John J. Egli was selected as the representative from the Signal Corps Engineering Laboratories because he not only is a propagation engineer, but he knows the AN/TRC well.

So, fortified by Office of the Chief Signal Officer, Radio Corporation of America, Central Radio Propagation Laboratories, and Signal Corps Engineering Laboratories representations, the group showed no obvious fear of approaching the problem in its forbidding lair. March 1, 1953 therefore saw these four scientists on their way to the unknown.

Their letters, from the first, indicated instance after instance where Very High Frequency radio relay siting of stations was being done just the opposite to instructions of ten years' standing! Instead of avoiding obstacles and keeping to line-of-sight radio transmission paths, the field was actually using paths with high obstructions in the way. The service men were violating scientific laws. So our scientists not being able to convince the radio operators that what they were doing was impossible, promptly passed new laws. They even discovered that old laws long on books could be used to explain that the so-called impossible was to be expected.

Nevertheless, the fact remains, that for possibly two or more years the Army, Air Force, and the Civil Aeronautics Authority radio communication personnel had not only been doing what was supposedly impossible, but were quite modest and quiet about it. In fact, they did not quite realize what they had, although they really used it.

Those radio men are so busy doing the impossible in so many things besides mere radio com-

munications, that this article can't begin to give them the proper credit. But at least in this one respect, they should know that the foremost radio and propagation experts in our country are enthusiastic in their recognition of this "Obstacle Gain," because it is an important basic contribution to the science and knowledge of radio propagation phenomena.

Our four experts spent about six weeks on their tour, visiting installations in Hawaii, Japan, Korea, and Alaska. They found the same story everywhere. Very High Frequency propagation was pulling strange tricks. They fitted the data into a predictable pattern very quickly, and there is no doubt now to all concerned that the expedition was successful and worthwhile beyond our best hopes.

Already methods for methodically using these data are being put into easily usable form for dissemination to the field and service schools. General Guest will have a textbook at his disposal. Not that he needs it personally, but he, at least, should now be able to be less of a lonely missionary in teaching these valuable facts.

Also, of course, the scientific importance has warranted immediate submission to professional publications. A paper jointly prepared by all four participants was read by Mr. Dickson at an open professional meeting in Washington, D. C., this past April.

Description of one particular radio communication circuit shows the whole matter. Along the Alaskan coast, for instance, our people found a radio relay circuit in almost a straight line consisting of two point-to-point links in tandem. Both links were using radio carrier frequencies of 40 to 50 megacycles. Number one link was one hundred miles in length. Number two was one hundred and sixty miles in length. Number one was having considerable trouble maintaining reliable communications even though its one hundred mile transmission path was clear of obstacles other than the curvature of the earth. Also it had many technical aids added to the equipment to bolster its communicating ability. These aids included large rhombic antennas as well as transmitter amplifiers and frequency diversity.

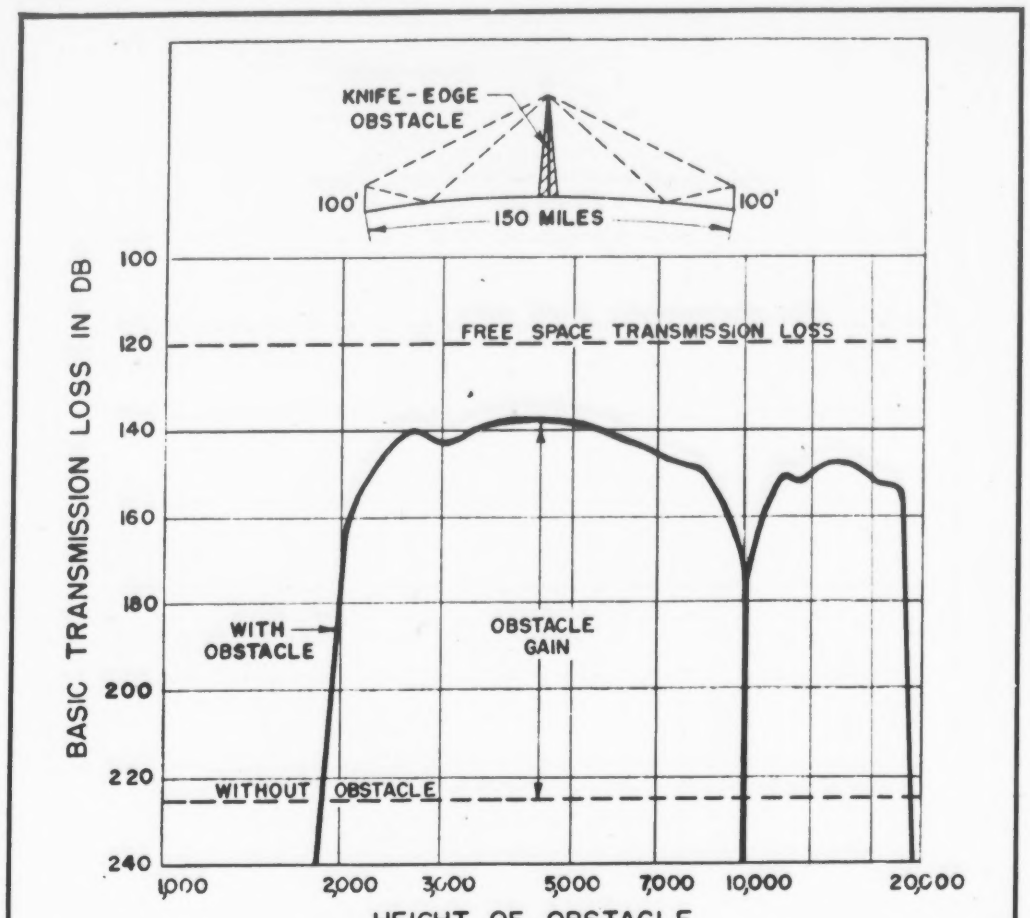


Figure 1—Theoretical obstacle gains at 100 mc assuming four-ray knife-edge diffraction theory.

In contrast the one hundred and sixty mile circuit had an eight thousand foot mountain at mid-path; to Very High Frequency propagation that, conservatively speaking, is an obstacle. In fact for practical purposes, previous to our new-found enlightenment, propagation people would agree that this was a barrier to any sensible Very High Frequency wave looking for a lonely receiver in back of the mountain. What a situation! If a souped-up transmitter and special antennas could hardly get over the one hundred mile path, what chance was there to communicate over the one hundred and sixty mile circuit?

At this point, we scientists, again previous to the enlightenment policy, would very authoritatively say, it can't be done. But not the soldier. His education hasn't been so stifling —besides he still has to get communication through; it has to be done some way. So he takes the easy way first. He tries to get through in one jump. The result: the one hundred and sixty mile distance is covered on one jump, obstacle and all. Better yet, no high-gain antennas and transmitter amplifiers are required. The signal? It is two to ten times higher than that obtained over the one hundred mile unobstructed path. Also it is solid, steady. It does not fade. The incoming microvolts are proof positive.

This lack of any appreciable fading is a big thing. It is, or rather was, unheard of in the very High Frequency region. If you watch television you know what happens to Very High Frequency. Your screen shows "snow" when changing propagation conditions bother those invisible rays between your receiver and the distant transmitter. Not so, with this method that the soldier, air force and CAA boys have worked up. Once the signal is received, it stays there, all day, all night, all year; and no fading.

That in brief is the story. A major scientific contribution to basic knowledge of radio propagation has been made, and used for two years by our armed service men.

Readers interested in a detailed explanation of the phenomena will find it in the August issue of the Proceedings of the Institute of Radio Engineer. A slight feeling of comfort may be immediately obtained, though, if you are bothered until you know the whys of such things, by a few knotty considerations indirectly obtained from the minds of our four scientists.

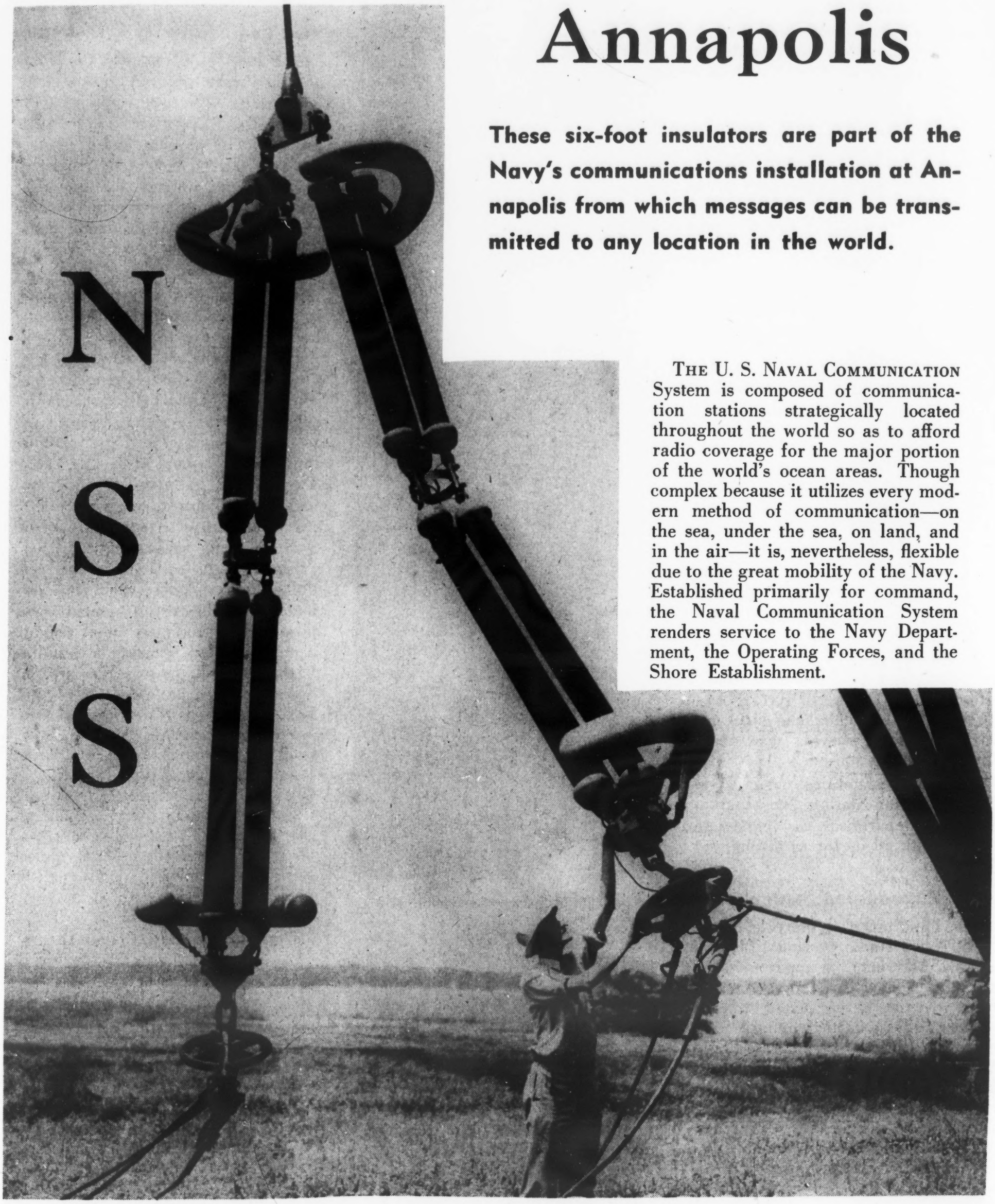
They reason that the phenomena is due first to an increased diffraction effect that accounts for the increased field strength, and secondly, to a decreased refraction effect that accounts for the reduced fading. Complex perhaps, but let's take a closer look to see how diffraction and refraction affect the radio field that way. Refraction, as used here, refers to bending of the invisible radio waves by the earth's changing atmospheric conditions. So we eliminate most of these earth-hugging changing-conditions by using a transmission path that is directed away from the earth's surface toward the top of the obstacle. Fading is caused by refraction, which is caused by changes in the atmospheric conditions, which are in turn most pronounced near the earth. It would therefore appear that the higher the obstacle the less the depth of fading of the received radio field strength.

The diffraction effect is merely the combining at the receiver site of the signals received by way of all possible paths between the transmitter and re-

(*Continued on page 74, col. 1*)

Naval Radio Station

Annapolis



These six-foot insulators are part of the Navy's communications installation at Annapolis from which messages can be transmitted to any location in the world.

THE U. S. NAVAL COMMUNICATION System is composed of communication stations strategically located throughout the world so as to afford radio coverage for the major portion of the world's ocean areas. Though complex because it utilizes every modern method of communication—on the sea, under the sea, on land, and in the air—it is, nevertheless, flexible due to the great mobility of the Navy. Established primarily for command, the Naval Communication System renders service to the Navy Department, the Operating Forces, and the Shore Establishment.

The shore communication facilities serving the Navy Department have become representative of the entire Naval Communication System. For administrative and command purposes, the communication centers have been combined with other activities performing associated communication functions to form naval communication stations (NAVCOMMSTA). Operationally, communication centers normally are composed of: a message center, a cryptocenter, a relay station, and radio stations.

NAVCOMMSTA Washington, D. C.

The U. S. Naval Communication Station, Washington, is under the military command of the Commandant, Potomac River Naval Command (PRNC), for those components located in PRNC. Those components located in the Severn River Naval Command (SRNC) are under the military control of the commandant of this command. Management control is the responsibility of the Chief of Naval Operations (CNO), through the Director, Naval Communications (DNC).

As the nerve center of the highly organized communication network, the U.S. Naval Communication Station, Washington, is composed of the communication center which operationally includes the message center, cryptocenter, and relay station located in the Navy Department Building in Washington, D. C. together with the naval radio stations (NAVRADSTA) in Annapolis, Maryland; Arlington, Virginia; and Cheltenham, Maryland: and the Registered Publication Issuing Office (RPIO). NAVRADSTA (R) Cheltenham is the receiving station, whereas the others are transmitting stations.

Through the facilities of the Naval Communication Station, Washington, the Navy Department has immediate contact with all its forces throughout the world.

Transmitting Station

The importance of the role of the U. S. Naval Radio Station (T), Annapolis, Maryland, is apparent when it is realized that it serves as the voice of the nerve center of the world's largest Naval Communication System. Initially commissioned in 1918, the station was referred to as a high-powered station. The name has survived as a local designation, attributable to the 500-kw. VLF transmitter and associated equipment. The transmitting antenna, supported by nine 600-foot steel towers, constitutes



Radio link antennas under construction.

a unique landmark. In addition, there is a veritable forest of bare poles supporting antenna wires, coordinated by rows of poles carrying an increasing number of radio transmission lines to the two large transmitter buildings. At its commissioning, NAVRADSTA Annapolis (NSS) became the highest powered station in a series of eight major Navy radio stations commissioned during the period 1913-1918. One of the transmitter buildings and four of the steel towers have been in continuous use since 1918 when NSS was commissioned with two 350-kw. arc transmitters. Later, the Navy began using vacuum tube transmitters at major stations. The NSS arcs were decommissioned in 1934 and replaced by the 500-kw. vacuum tube VLF transmitter.

Very Low Frequency Transmitter

The 500-kw. VLF transmitter operates on a wave length of approximately ten miles. The tower-supported antenna is some 1000 feet wide by 4000 feet long. Its physical characteristics are kept fairly constant by means of tower counter-weights totalling 100 tons. There are approximately 10 miles of cable in the antenna alone while the antenna covers approximately 100 acres.

The transmitter proper is housed in an aluminum bungalow with four house-size doors for access. Amplifier tuning coils are so large that men go inside them for close inspection. The ceiling of the helix house adjacent to the transmitter is 50 feet high to accommodate the huge antenna tuning coils wound with Litz cable. Two cables in parallel, each two inches in diameter, are required to carry the enormous antenna current. Such a strong radio frequency field exists near the coils that fluorescent bulbs light up when held in one's hand, and a nearby grounded water pipe and a grounded metal conduit can be shorted, causing a blinding flash. At full power, the antenna downlead, some 35 feet above ground, has 250,000 volts RMS present. Average voltage per foot between downlead and ground is some 7000 volts. Persons wearing nailed leather shoe soles have had their feet burned walking near this field. Once a mounted marine sentry, passing the downlead at some forty feet, suffered a flesh burn where his leg lay against a harness buckle.

High Frequency Transmitters

Most of the station's service is performed by the less spectacular high frequency transmitters, rated between 2- and 40-kw. output. Adjustments of these transmitters are made manually and by servo-mechanisms. To cool the transmitters, both forced air and water cooling systems are employed. However, the water cooling systems are becoming obsolete as larger air-cooled transmitter tubes are perfected. Heat from both cool-

ing systems is currently used during the winter months to heat the transmitter rooms.

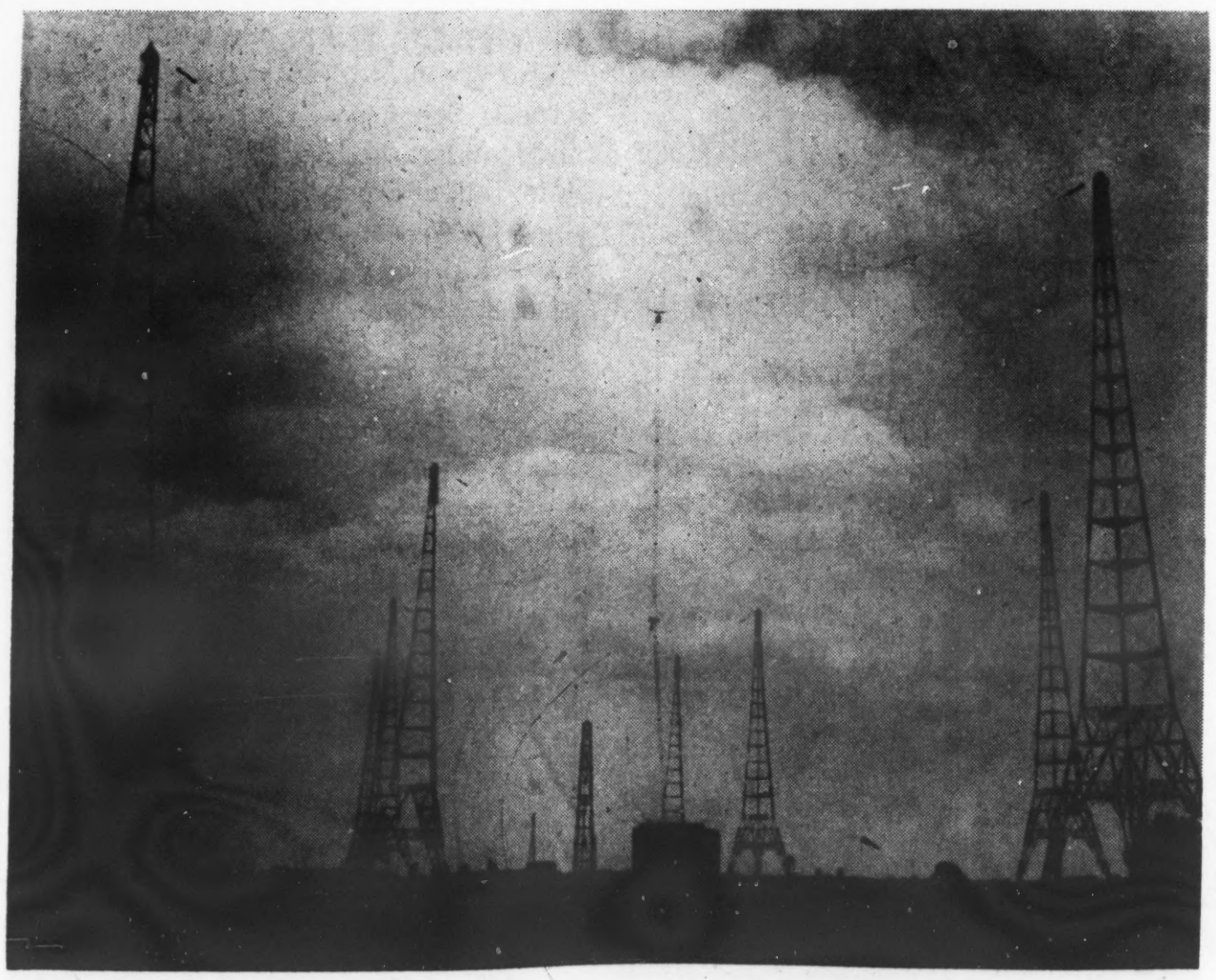
To effect the transoceanic and transcontinental transmissions, the transmitting station at Annapolis is equipped and manned as an automatic traffic relay point. Communications are translated to low or high frequencies as required, and considerably amplified in power prior to transmission.

Since long-distance transmitting service is supplied continuously, transmitters of suitable power must be furnished promptly on the specific operating frequencies when requested by the Naval Communication Center, Washington, D. C. At the same time, antennas designed for the operating frequencies and the geographical service areas must be provided. Facilities and personnel must be in constant readiness to restore immediately transmitting service with stand-by equipment in case outgoing communications are interrupted because of equipment failure. To meet present service requirements, some 60 radio transmitters and 100 antennas of various types are in commission. (However, the future operating requirements are such that a new windowless, air-conditioned, strictly functional transmitter building, and its associated antennas, including one 800-foot tower, is being constructed.) To provide against individual transmitter or antenna failure, and to meet broad military requirements, a high degree of flexibility in joint antenna-transmitter employment is obtained with radio frequency transmission line-switching stations. These rugged, highly practical installations are a significant operational feature. While antennas are the point of departure of the radio signals, the incoming communications arrive via radio link or landline at the terminal equipments. The terminal facilities form another system which requires precise adjustment before long-distance radio communications can be effective. On one point-to-point communication circuit, i.e., from the Naval Communication Station, Washington, D. C., to the Naval Communication Station, Pearl Harbor, there is perhaps the most complex aggregation of electronic and auxilliary equipment in continuous, co-ordinated operation in peacetime.

Facilities and Services

NSS serves the Navy Department continuously with varied types of communications. Outstanding advances have been made since the transmitters were first manually keyed over direct current control lines from Washington to Annapolis. The use of keyed audio-frequency tones, in place of direct current keying, has overcome distance limitations of remote transmitter keying and achieved the necessary precision of the tone pulses to make automatic teletypewriter and multiplex transmissions reliable. Facsimile transmissions are now routine; these and radio-teletypewriter signals are transmitted by frequency-shift methods that improve the reliability of long-distance transmission equivalent to a transmitter power increase of approximately 20 times. On major circuits, single-sideband transmitters are employed which are capable of transmitting six teletypewriter messages and one voice conversation at the same time.

VLF antenna; approximately 1,000 to 4,000 feet.



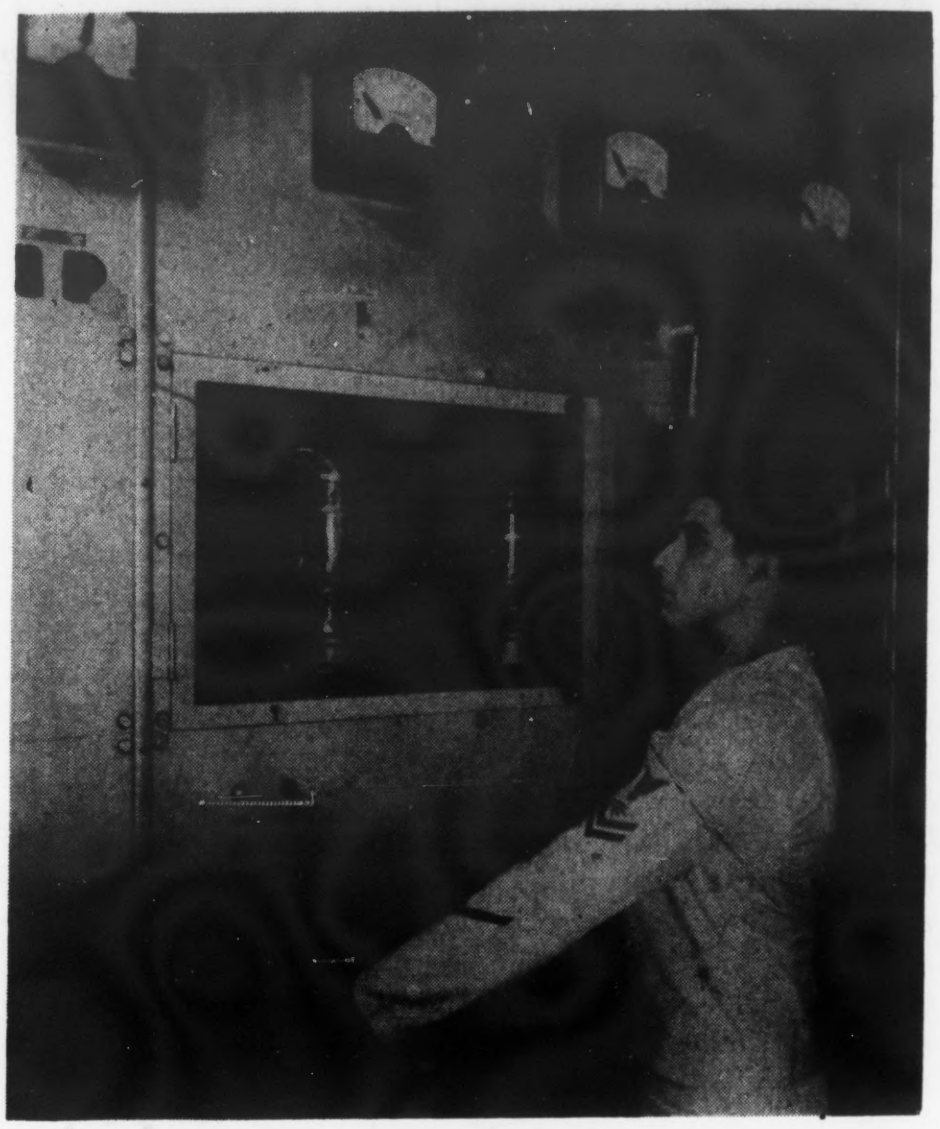
Broadcast Service

Long-distance transmissions fall into the broadcast, ship-to-shore and point-to-point groups. By means of broadcasts, ships anywhere in the Atlantic and other areas served by NSS, receive communications without the need for breaking radio silence. Because ships may be just off the coast or thousands of miles away, and because no single radio frequency is suitable at all distances involved, the broadcasts are transmitted simultaneously on several frequencies. Reception on board ship may be on one or more of these frequencies as conditions require. The Atlantic Ocean Area lies over a broad range of bearings from Annapolis, and broadcast transmissions must be directed accordingly by suitable transmitting antennas. Marconi antennas and half-wave doublets in various arrangements are suitable for this service. The doublet antennas may be single-wire antennas oriented parallel to the average coastal direction, or may be a suitable directional antenna array increasing transmission to seaward while reducing transmission inland. Broadcasts and individual ship-to-shore transmissions still employ the original continuous-wave, or carrier-on/carrier-off, method of signaling, although frequency-shift is being used on some broadcasts.

Point-To-Point Service

Contrasted to broadcast service, the point-to-point service requires the most concentrated radio beam transmission compatible with the frequencies employed. Where the broadcast service antenna covers an angular sector similar to a floodlight, the point-to-point service antenna must concentrate the radio energy like a searchlight beam. This is because the transmission is to one single geographical point, usually on a single transmitting frequency, and a strong dependable signal is required, with a minimum of power consumption. Concentration of the signal is secured

by the use of a rhombic antenna, a structure some 200 by 600 feet or longer, carefully erected on the desired great circle bearing (i.e., shortest distance bearing) toward the distant radio receiving station. Each distant base, transcontinental or transoceanic, in direct radio communication with the Naval Communication Station, Washington, is served by one or more rhombic antennas. Transmissions to such bases include all messages destined for the ocean area for which the base serves as a communication center, and for more distant points for which the base serves as a traffic relay point.



Gilbert Madrig, RM-2, tunes intermediate power amplifier, part of the 500-KW equipment at NAVRADSTA (T) Annapolis.

Recent Developments

Facsimile is a relatively new high frequency service. When a Navy task force went to the Antarctic in 1948, the pictorial news of the expedition came by Navy facsimile transmission. Transmission by facsimile of certain printed material, charts, and weather maps is now well established. Under some conditions of interference, this method of transmission is superior to radioteletypewriter. The latter is transmitted by a series of pulses, the loss of one of which may garble a character. Under conditions of intermittent interference many characters may be lost. In facsimile transmission, the printed material is scanned several times per line of printing. Parts of one or several scanning lines may be interrupted by interference without losing the intelligibility of the printed material. Prior to adoption of certain new communication equipment and methods, Naval Radio Station (T), Annapolis has taken part in field tests and evaluation, including micro-wave link equipment, transmitting antenna design, and refinements in long-distance communication methods.



Down lead entrance to Helix house, 500-KW transmitter. The tower is one of nine 600-foot towers.

Overall Proficiency

Operating frequencies are maintained at Annapolis to the Navy tolerance of plus and minus 0.003% in the high frequency range, by periodic check measurements made at the station. In addition to maintaining transmitter frequencies within tolerance, and checking for normal operation and performance of transmitters, operating personnel maintain surveillance over the terminal control equipment and associated link receiving equipment to insure continuous operation. Suitable signal levels at Annapolis rely upon close signal tolerance maintained at the Naval Communication Station, Washington and the VHF transmitting station, Arlington. Equipment failure or maladjustment at those points adversely affect ultimate transmission from the transmitters at Annapolis. However, through the coordination of the Naval Communication Station, Washington and mutual cooperation of operating and maintenance personnel at the three stations, the outages for outgoing communications due to personnel and equipment failures at Annapolis are remarkably small. The percentage of uninterrupted transmitter-hours service rendered annually by Naval Radio Station (T), Annapolis, Maryland, is of the order of 99 and 99/100% continuous.

Advanced Electronic Center at Cornell

by H. R. Oldfield, Jr.
Manager of the Center

"FAR ABOVE CAYUGA'S WATERS," an unusual concept in industry-university cooperation has passed through the experimental stage and is now a dynamic reality. The General Electric Advanced Electronics Center at Cornell University, merely an idea in the heads of a half a dozen people some eighteen months ago, has now weathered the initial pangs of birth and reached the status of a stable operation. Conceived during an acute shortage of engineering and scientific personnel, this organization was founded on the gamble that people of talent and vision would be atracted to an environment primarily oriented to creative thought and work. The wisdom of this move has been proven and has resulted in the rapid formation of a completely new electronics research and development facility, comparable in size to those which have been financed at great expense by large Government projects established directly at universities or other organizations. The Advanced Electronics Center differs from these Government projects in four important respects:

1. It is established for the long pull as a laboratory devoted to electronics research and development, rather than being tied to some specific field of military endeavor.

2. It is being financed by industrial appropriation with no investment of Government funds and at a modest cost differing from the nearest equivalent Government project by more than a full order of magnitude. This differential appears understandable in that the government operation generally requires a staff and facilities build-up starting from a relatively low level of experience availability.

3. As an integral part of a General Electric operating division, the Center is in a position to apply the fruits of its research and development efforts to useful production systems without the difficult and time consuming "transition" problem that faces most university projects.

4. Cornell University does not benefit financially from the work done at the Center. This does not, however, prevent faculty members from participating in the Center's programs as individuals; rather such participation is encouraged and is one of the most important features of the organization.

History

The basic concept of the Advanced Electronics Center was first propounded in the spring of 1951 by Dr. Lloyd T. De Vore, Manager of G.E.'s Electronics Laboratory in Syracuse, in response to a request by the military to establish a large research and development group

devoted to a particularly pressing military problem. The project was too large to be handled within Electronics Park. Syracuse, without serious dislocation of other programs; besides, the engineering manpower bottleneck was so serious at the time that the thought of staffing such a project was almost laughable. In discussions of this problem throughout the spring, it became increasingly evident that some hitherto untapped source of scientific and engineering manpower would have to be explored. This naturally led to the possibility of establishing the project at a university, either as a direct Government contract or as a cooperative effort. The possibility of a direct Government-University contract was ruled out in this case, primarily because of the necessity to move from advanced development to pre-production samples in as rapid a manner as possible.

While this planning was in progress, considerable scrutiny was given by Electronics Division management to a number of rather large programs then being placed by the Government directly in universities. There appeared to be considerable merit in such programs inasmuch as the relatively large sources of brilliant scientific skills peculiar to technical universities were readily available for the actual performance of the programs. Furthermore, experience with the MIT Radiation Laboratory had indicated that there was considerable appeal to the university atmosphere, and that many of the most talented scientists and engineers preferred to work in such surroundings. While recognizing these important advantages, it was possible also to foresee at least two drawbacks to this type of operation. First, there was some thought that too much emphasis on large military programs might eventually detract from the basic function of these universities in the training of engineers and scientists for industry. Even at that time, for instance, it had been noted that the major competitors for high caliber manpower were the universities themselves—a case of eating one's own young, so to speak. . . . Second, and equally distressing, there was the fact that the universities were necessarily somewhat removed from industry; hence, the problems of transferring ideas and techniques into usable production equipment were particularly acute.



The application of transistors to military electronic systems is undertaken at the Center in various research, development, and model-design programs. The objectives of these studies are: 1) the generation of basic circuit knowledge and techniques that will serve as future "building blocks" for personnel engaged in transistor application engineering; and 2) the determination of optimum package-design concepts in subminiaturization, unitized construction, and ruggedization consistent with the inherent character of the transistor.

In evolving the operational philosophy of the Advanced Electronics Center, considerable thought was given to these relative advantages and disadvantages of an industry-university activity. It was finally concluded that an industrial concern and a university, by cooperating to the fullest extent, could overcome many of the pitfalls without either of them sacrificing their virtues, and it was decided to establish the Advanced Electronics Center at *Blank* University. It is interesting to note at this point that the original Government project which had stimulated all of this planning had receded into the background. It was decided, therefore, that the activity should be organized on a broad basis, covering a variety of phases of the electronics field, and including unclassified as well as classified projects. It was decided also that, if successful, the activity would become a permanent installation rather than one geared to a particular class of problems.

Here an engineer is checking the infrared sensitivity of a detection system. Basic and applied research in infrared is being carried out at the Center. This research leads to the development and advanced development of equipment programs which are an integral part of the Center's activity.



Events moved rapidly from this point on. One look at the Cornell University campus in the spring, not a little influenced by the scholastic mien of the Cornell co-eds, persuaded the management that here was a likely location for a laboratory. Among the more serious influences were the high caliber of the Cornell College of Engineering and College of Arts and Sciences, the progressive attitude of the Cornell University faculty, the excellent geographic location, and the fact that Cornell was not then engaged in any large Government programs in Ithaca. Even more persuasive, perhaps, was the general atmosphere of this great university where the student, knowledge, and the inter-relationships of the two are preeminent. It was felt at the time — as has since been justified — that a completely successful industry-university program would have to be integrated

to some extent with undergraduate and graduate activities in order to be of long-term utility to the University as well as to the industrial concern.

In July, 1951, representatives of the General Electric Company and Cornell University initiated a series of conferences to determine, first, the basic mutual desirability of establishing such a laboratory at Ithaca, and, second, the general set of ground rules under which such an organization should operate. It was almost immediately decided that there should be no contractual or financial arrangement covering the cooperative effort, but that the entire program should be covered by an agreement outlining the broad framework of mutual trust and cooperation. A few statements from the agreement characterizing its intent are quoted below:

Contract Terms

"The General Electric Company will establish on the grounds of Cornell University, an advanced development laboratory to be known as the General Electric Advanced Electronics Center at Cornell University."

"Projects will be assigned to the Center in one or more of the fields of advanced electronics, infra-red, supersonics, and the sciences related thereto."

"It will be Company policy not to assign projects to the Center against the wishes of Cornell."

"The Scientific Staff of the Center will be selected by General Electric with the advice of representatives of Cornell."

"Cornell may in its discretion give faculty appointments without academic tenure or voting privileges to certain members of the Scientific Staff and accord to those selected such faculty privileges as may seem appropriate. General Electric agrees that those members of the Scientific Staff of the Center who are given faculty appointments may teach appropriate classes at Cornell University."

"Certain members of the Center Staff, though not given faculty appointments, will be eligible for those social and athletic privileges normally accorded to Cornell Staff members, compatible with the rules of the several campus organizations."

"General Electric may permit students performing work at the Center to carry out work on their theses at the Center."

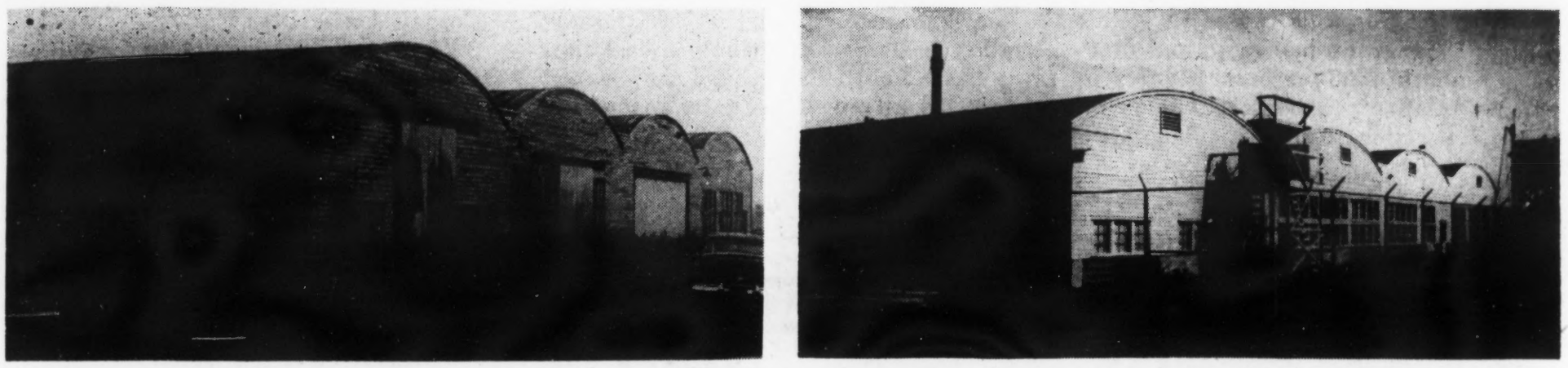
"One or more associate chief scientists from the Faculty may be chosen to assist and advise the staff at the Center."

"It is understood and agreed by the Company and Cornell that this entire agreement is mutually non-exclusive."

The agreement was signed in the fall of 1951, and work began immediately on the laboratory building. It was decided to rehabilitate and modernize a portion of an existing laboratory building at the Cornell University airport rather than to build a new installation. This proved to be a speedy and economical move, and the first phase of the construction program was completed by February 15, 1952. In the meantime, a nucleus of three people, two engineers and one secretary, had taken up temporary residence in Franklin Hall, the home of the School of Electrical Engineering at Cornell. This group began work immediately on a Signal Corps study contract and, at the same time, initiated a recruiting program aimed at building up the staff at the highest possible rate. To insure that quality was not sacrificed for the sake of quantity, the task of interviewing prospective employees was shared by Cornell University staff members, with the result that offers of employment were made only to those who could meet the exacting standards, both professionally and academically, which this type of venture warrants.

It is always a pleasant experience when a good idea pays off as originally anticipated. This happened in the case of the Center program. It was found that a large number of scientists and engineers were quickly atracted to the work-study-teach program which was being established at the Center and, although no advertisements or employee solicitations were extended, it was possible at all times to keep up with the planned program of expansion. It is most gratifying to note that there was no attempt made at any time to "buy" engineers or scientists by offering salaries calculated to be well above the norms of the universities or other commercial concerns. This is in itself a unique tribute to the nature of the Center rather than to a recruiting campaign.

By October, 1952, the Advanced Electronics Center had grown to a size of eighty-three persons, including scientific, engineering, and administrative personnel. It was decided at that time, on the basis of such excellent personnel response, to rehabilitate and equip the remainder of the available building, looking toward a total strength of 170-200 people. As this article is being written, the construction program has been completed, but the continuing response of scientific talent has encouraged further growth of physical accommodations to house a full-time staff of about three hundred persons. This growth has required a building expansion of approximately 10,000 square feet over the present operating area of 20,000 square feet, and such expansion has already been initiated. The net result is a modern, completely air-conditioned laboratory with unparalleled facilities, tailored to an ultimate strength of 300 persons. In addition, the Center retains the full and part-time services of a large group of Cornell University faculty members.



On the left is the old Cornell aeronautical laboratory as it appeared late in 1951, looking from the Mohawk Airlines airport premises; and on the right is the same view of the structure today as a modern 30,000 square-foot air conditioned establishment where advanced electronic research and development projects are carried out by General Electric.

Organization

The Advanced Electronics Center is organized along the lines shown in the block diagram of figure a. This is a simple, functional organization, with each of the major areas of research and advanced development being formed under a Research Supervisor who reports directly to the Manager. Each major project, after assignment to the Section having primary cognizance, is organized on a Task Force basis. Men are assigned to the project from any or all of the section, as their talents may be required, and are placed under the direction of a Project Engineer, to whom they report during the active life of the project. This completely fixes responsibility and, at the same time, permits a facile utilization of the diverse talents available in the different sections.

The activities of the Advanced Electronics Center are divided between *advanced development* and *research*. In general, the advanced development activities are concerned with systems in the broadest and most complex sense, covering the entire field of electronics and the allied sciences. The research activities are concerned primarily with

those theoretical analyses, techniques, and components problems which are necessary to support and enhance the systems research effort. In addition, independent research programs have been established in certain areas of critical interest.

The advanced development activities are carried out by the Airborne Systems Section, Ground and Shipborne Systems Section and the Special Projects Section. These sections are presently engaged in systems research and development on military systems, with particular emphasis on fundamental problems of air navigation, air defense, guided missile control, electronic warfare, and airborne detection systems. While most of these projects are classified in nature, they are sufficiently basic to permit the build-up of skilled task forces capable of being applied to either military or commercial problems in the years to come.

The Analytical Section, as its name implies, is concerned with research of a highly analytical nature. It is composed of electrical engineers, physicists, chemists, and mathematicians welded into a small but highly skilled organization. The group has a two-fold function: first, to conduct basic studies in new or relatively unexplored fields involving operations research, communications theory, and the like; second, to provide assistance to the other sections in accomplishing the analytical portions of their advanced development program. The activities of this group have proved so productive that it is being continuously expanded in size and scope. A large scale analogue computer installation is underway as a working tool for this group.

The Techniques and Components Section is the newest section conceived in the Center's scheme of operation. Its activities encompass most of the basic research to be conducted at the Center, especially unclassified research. Emphasis is placed upon the creation of techniques and components suggested by the needs of the systems sections.

The nucleus of the group is a collection of specialists in such fields as microwave antennas, computers, seismology, microwave receivers, optics, subminiaturization, psychology, infrared, and other widely varied fields of interest to the Center. This nucleus is supplemented by staff members and graduate students from Cornell University who operate on a part or full-time retainer basis and contribute a vast fund of basic knowledge which can be utilized by all of the Center's scientific groups.

Facilities

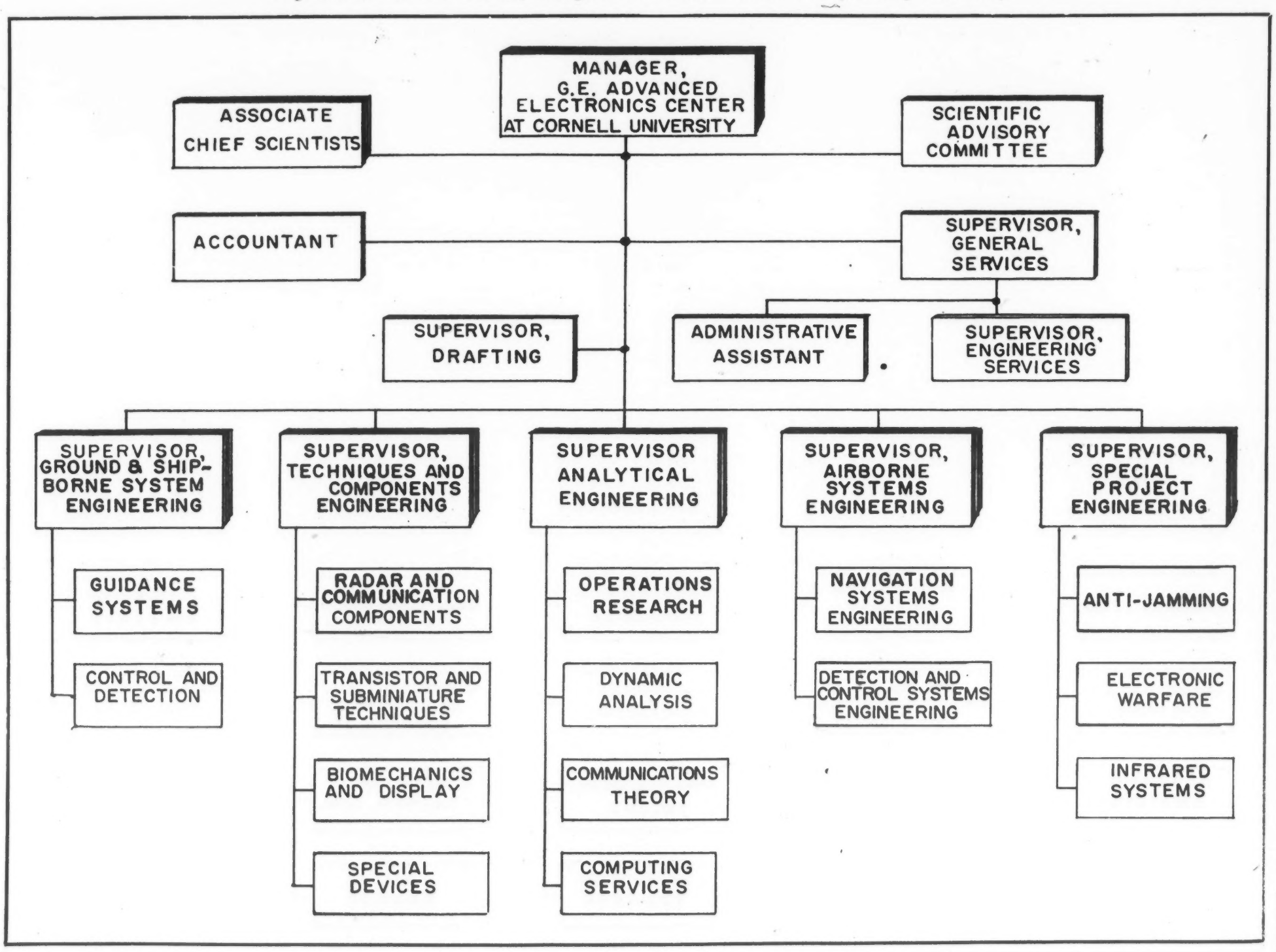
Aiding the staff of creative engineers and scientists is a specially trained group which provides all essential technical services such as:

Mechanical Design. A complete mechanical design and design drafting section is available. Skilled designers and detailers work closely with the engineers, and remove from them much of the routine load concerned with actual equipment design. This permits the application of good, consistent design practice to experimental equipment. Such a highly desirable practice is not allowed to interfere with freedom of action in regard to the design and construction of breadboard circuits in the laboratory, and is aimed primarily at relieving the engineers of all routine design chores.

Fabrication. A complete model shop has been established at the Center, manned by skilled craftsmen. It is supplemented by fabrication and welding facilities maintained by Mohawk Airlines, just across the street from the Center. These facilities are further augmented by local industry and by Cornell University.

Duplication. A completely equipped photographic laboratory is available to the Center engineers in addition to all normal duplication facilities.

Organization of the Center, designed to achieve maximum operating efficiency.



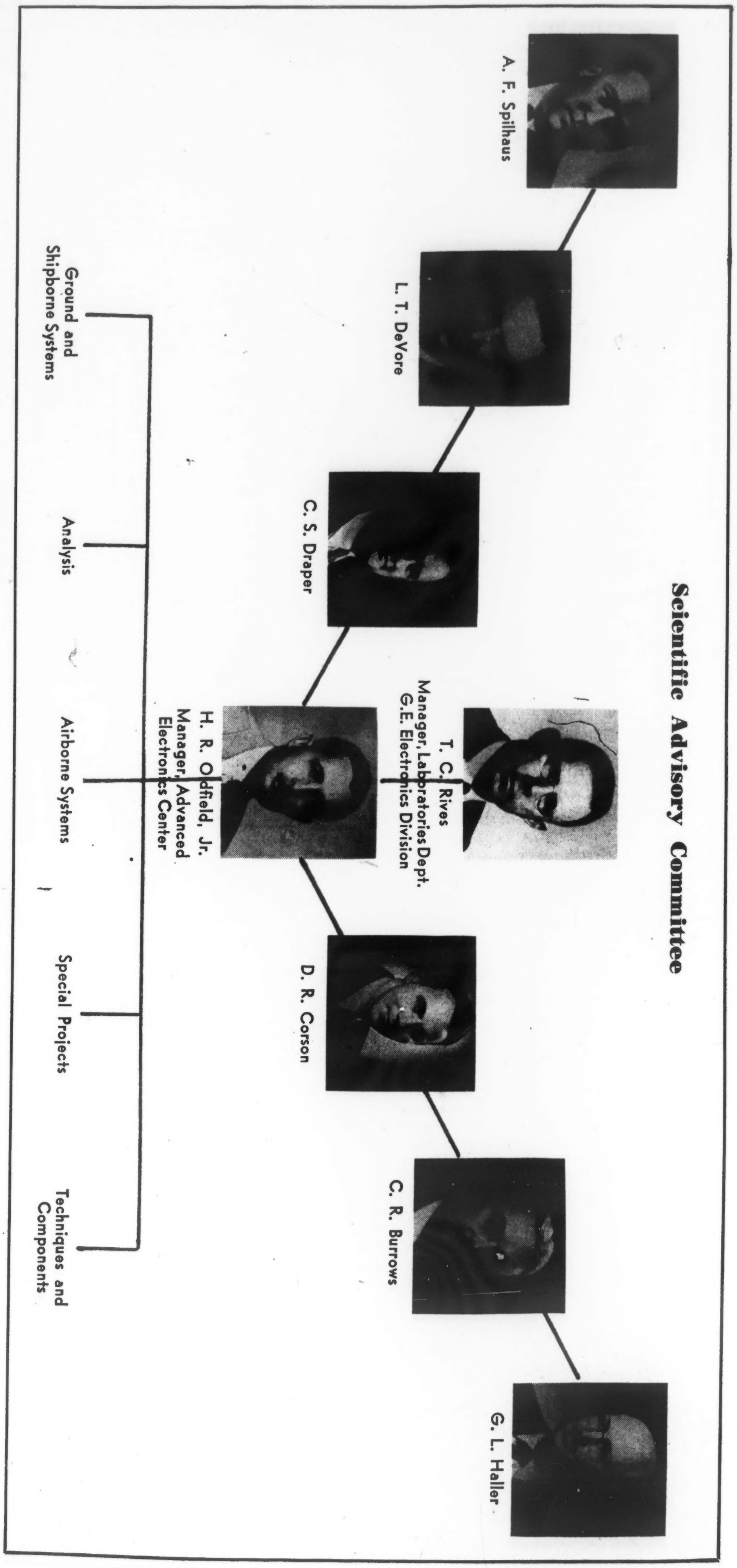
Flight Test. Arrangements have been made with the neighboring Mohawk Airlines for complete flight test facilities, including: installation crews, flight crews, maintenance, ground-air radio communications, and other supporting facilities.

Library. A complete library and reading room is available at the Center. In addition, all Cornell University library facilities are available to the scientific staff of the Center.

Technical Publications. Technical reports and publications are handled through an experienced staff of technically trained personnel interested in the art of narration and exposition. This staff is set up to ease the writing burden of the scientist and to produce and publish all scientific literature conceived by the scientist for purposes of periodical or report form publication. The scientist is encouraged to write extensively in his particular field by the aids provided in this section, the aids including writing assistance, editing, technical illustrating and the assumption of detailed publication responsibilities.

To round out the organization of the Center, there is a complete administrative staff. This staff has been formed for the purpose of *serving* the engineering and scientific groups rather than directing them. Every effort has been made to keep all detailed administrative chores out of the hair of the Supervisors in order that the latter individuals can devote their efforts to creative thinking and technical leadership. In general, the technical level of the engineering group is so high that there is little need for establishing strict procedures; hence, the administrative group is concerned with services rather than routines. This permits a full-time concentration on the all-important areas of purchasing, accounting, employee services, security, etc. The net result is a smooth running organization free of burdensome restrictions and in complete control of its internal routines and finances.

It is interesting to note the unusual operational characteristics of the Center even within the company structure of General Electric from a production standpoint. Basically, one may say that the Center is formed to conceive new techniques and prototype systems for the product design and manufacturing organizations of the Commercial and Government Equipment Department of the Electronics Division. It is just such an organizational tie-in with the groups which will ultimately manufacture the equipment that insures a rapid and orderly transition from the advanced development or "idea" stage to production equipment. The continuous tempering of the Center's programs by a realization of what is physically realizable in the factory is aimed at cutting months, and even years, from this transition period. At the same time, the constant exposure to academic phil-



osophy prevents these practical considerations from dominating research activities. The result is a stimulating environment which is unique in the electronics industry.

While the Center is a part of the Commercial and Government Equipment Department, its activities are closely allied to those of a number of other research and development organizations within the General Electric family. Each of these organizations possesses special skills which are constantly on tap through an extensive and effective liaison activity. Among the more prominent of these groups are the following:

The *Research Laboratory* at Schenectady which conducts fundamental research programs of a very broad nature for all divisions of the Company.

The *General Engineering Laboratory* at Schenectady which deals with broad engineering problems of interest to many divisions of the Company.

The *Electronics Laboratory* at Syracuse which carries on a program of applied research of a more specialized nature than that of the Research Laboratory.

The *Aircraft and Ordnance Systems Division* of the Defense Products Group, whose advanced development groups pioneer in the complex field of modern ordnance.

The existence of these, and other, laboratories within the Company structure acts to magnify the effective size of the Center several fold. At the same time, the decentralization of the management function permits the Center to operate with the speed and freedom of a small company. The net effect is a very fast moving program, tailored to the needs of the military services and to industry.

Scientific Advisory Committee

A Scientific Advisory Committee composed of outstanding engineers and scientists lends a firm and reassuring hand to the conduct of Center activities.



An engineer is shown investigating a particular technique for displaying information on a PPI. Many radar systems require a composite electronic display of radar video on which is superimposed significant markers, numbers and symbols, and the Center is actively engaged in development work pertaining to display accuracy and to the reduction of equipment complexity.

Regular periodic meetings are held by the committee in order to maintain an intimate working relationship between the Center and relevant scientific fields of activities. In addition to the distinguished abilities of these advisers to succesfully engage the comprehensive operational problems of a modern laboratory such as the Center, individual members make available their own specialized talents and knowledge as is required by current research and advanced development programs.

The members of the Advisory Committee are:

Brig. Gen. Tom C. Rives (B.S. in E.E., and M.S. in E.E, Auburn and Yale), USAF Retired, Manager of Technical Military Liaison, General Electric Company, under whose broad direction the Center functions. Gen. Rives brings to the Committee a rich variety of experience in the research, practice and management phases of electronic engineering. This experience was accumulated in successful accomplishments as Chief of the Electronics Subdivision of the Air Materiel Command (USAF), senior Air Force Member of the Electronics Committee of the Research and Development Board, Chief of the Research and Development Division in the Office of the Chief Signal Officer, Deputy Air Communication Officer, and, upon retirement from the USAF, Research Associate Professor in the Department of Electrical Engineering of the University of Illinois.

Mr. H. R. Oldfield, Jr. (M.S., Aero. Eng., MIT), Manager of the Center, who is responsible for all phases of the Center's operation. Mr. Oldfield was formerly a member of the faculty at the Massachusetts Institute of Technology, serving as a research assistant and instructor in the Instrumentation Laboratory. While in military service, he was prominent in the development and application of microwave techniques as applied to antiaircraft fire control, and was later in charge of an Air Force program for developing airborne fire control radar systems. Subsequently, Mr. Oldfield joined the General Electric Company as an applications engineer and shortly thereafter became Manager of Sales for the Government Division. He was Operations Manager of the Center prior to his present appointment.

Prof. Charles R. Burrows (Ph.D., Physics, Columbia), who is Director of the School of Electrical Engineering of Cornell and one of two Associate Chief Scientists appointed to the Center on a personal basis to aid in the planning and monitoring of Center activities. He is a leading authority on the propagation of electromagnetic waves and has contributed significantly to the development of the proximity fuse, radar equipment and countermeasures techniques.

Prof. Dale R. Corson (Ph.D., Physics, Univ. of Calif.), is a member of the Physics faculty at Cornell and is also an Associate Chief Scientist at the Cen-

(*Continued on page* 74, *col.* 2)

The measurement of electromagnetic horn patterns and phase centers is one of the many different types of research and development work being carried on in the field of microwaves. Problems ranging from electromagnetic wave propagation to design and testing of various types of microwave antennas are being studied and solved.



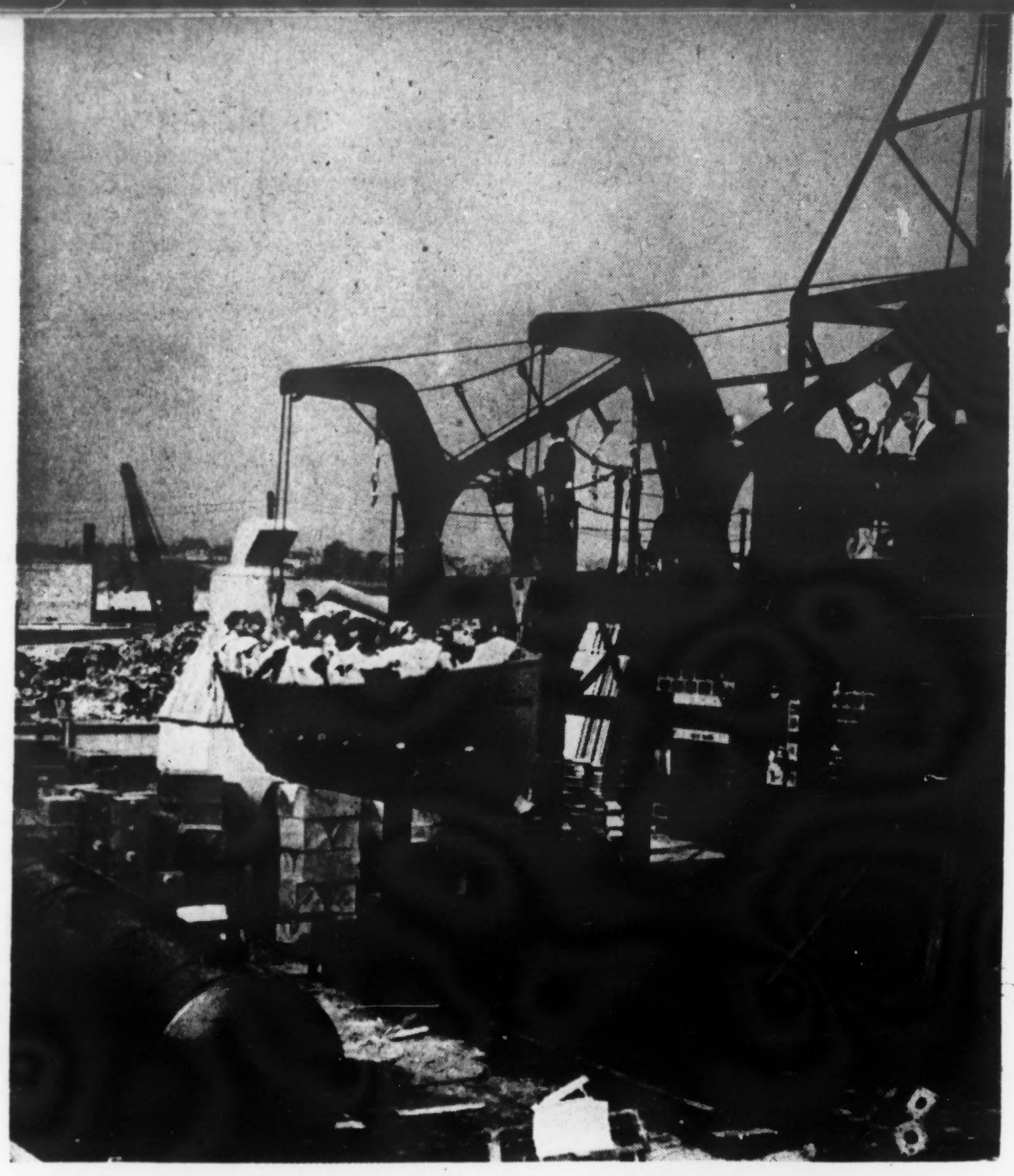


Not an open-mouthed monster waiting for a snack, but a big tanker after a collision with a sister ship. This picture was studied by the Merchant Marine Inspection Division which investigated this marine traffic accident.

from Coast Guard Files

PICTURES PLAY AN IMPORTANT ROLE IN OPERATIONS of the Coast Guard. Just as the camera has become a major weapon in modern warfare, so do messages in picture record important phases of the Coast Guard's work. Pictures of casualties at sea and of structural failures in vessels are used as evidence in investigations by the Merchant Marine Inspection and Technical Divisions. Pictures of rescue operations serve not only to inform the public of newsworthy events but may suggest improvement in rescue operations and equipment. The camera provides permanent records of split-second action which often grow dim in memory. Truly, the picture has become the foundation of visual communication, whether still or motion or even the fleeting image on a radar scope.

This shot of any cameraman's lifetime shows a tanker actually breaking in two. It comes from the files of the Coast Guard's Merchant Marine Inspection Division. Such pictures may indicate the presence of structural faults which can be corrected in the design of future ships.

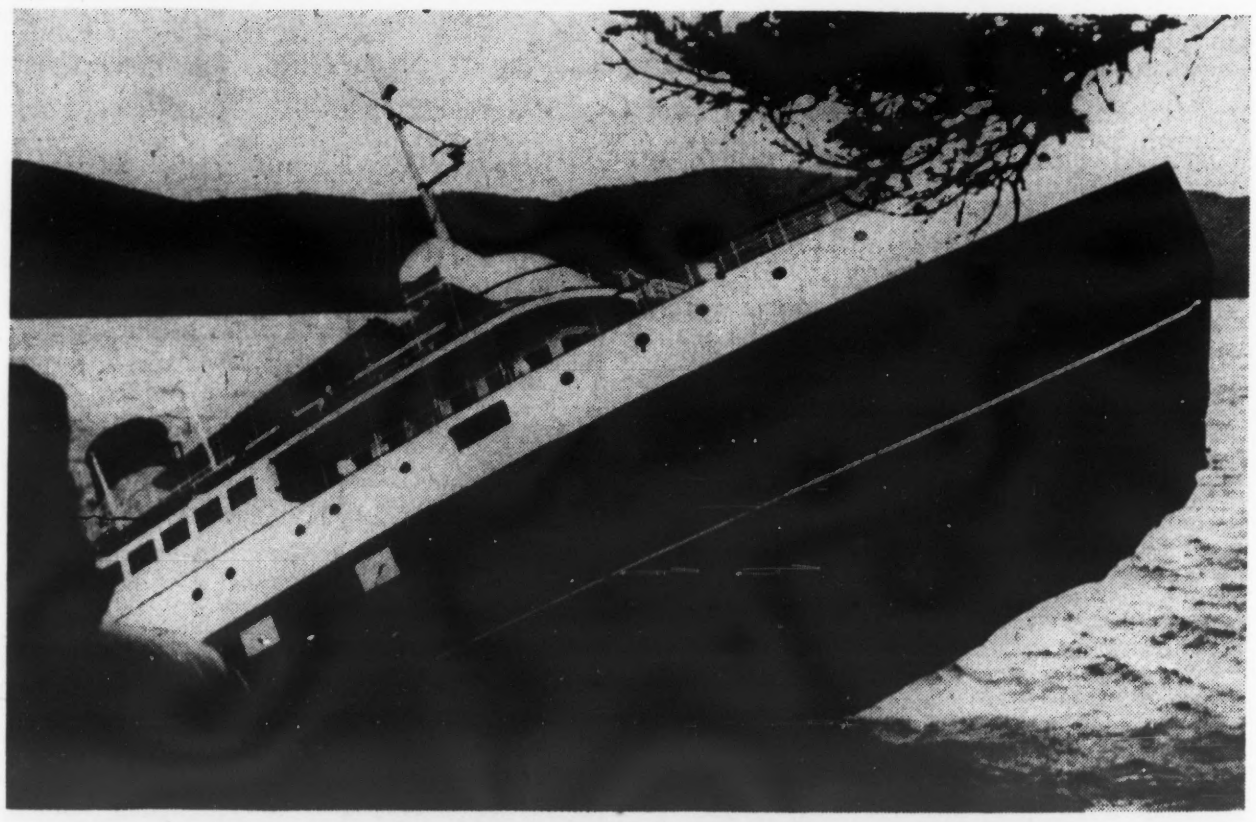


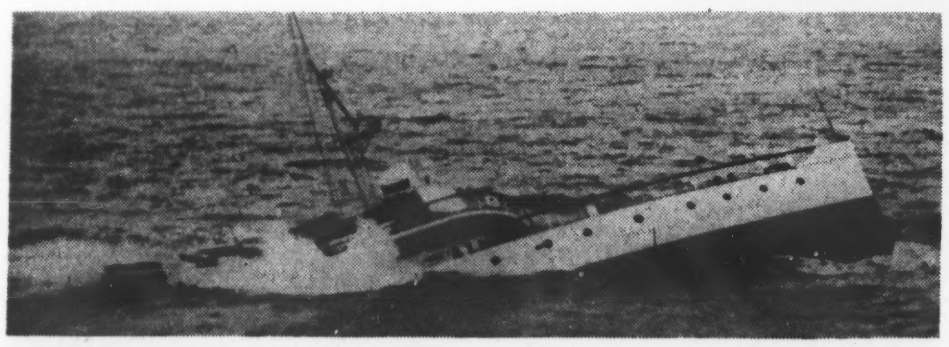
Here we have what seems to be a dry-land launching of a lifeboat full of passengers. Actually, it is a test of a new type of davits. The whole apparatus was built on shore for convenience of inspection and the passengers are the mechanics on the job. Such tests often are recorded by motion picture for information of Coast Guard technical officers who cannot be present at test.

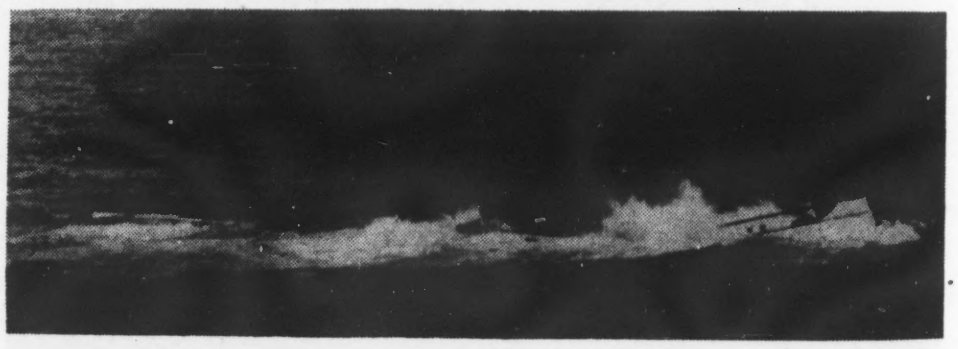


America's queen of the seas, the *U.S.S. United States*, like the lowly tugs that help her to dock, must be inspected by the Coast Guard. Here merchant marine inspectors observe an emergency drill aboard the vessel.

This passenger vessel, the *Princess Kathleen*, ran aground and sank without loss of life. Coast Guard pictures show how the *Princess Kathleen* rammed her royal nose against the unyielding shore, then slipped off the rocks and sank in deep water.











Upper: In the Merchant Marine Inspection Division files, this picture is marked "Exhibit 6-G." It shows all that remained of the *Island Queen* which burned after an explosion at Pittsburgh. Lower: An inspector views the torn deck plating above the fuel tanks of the *Island Queen*.

Servicing light buoys along the coastal waters is one of the Coast Guard's many aids to navigation, whether it is a time of war or peace. Here, a light buoy is hoisted to the deck of the buoy tender for overhauling and repairs.



From the frigid arctic comes this view of the USCG Cutter *Northwind* at work among the icebergs. Still pictures such as this, showing actual working conditions, are invaluable to the Coast Guard officers who make plans for such operations.



"I Remember . . ."

Brig. Gen. John J. Carty wrote this article for the first and only issue of *Military Signal Communications* published in May, 1927, one year after the founding of the American Signal Corps Association. Although written after World War I, his words can be readily adapted to the situation today.

THE MILITARY OPERATIONS OF THE LATE WAR demonstrated on a colossal scale the vital necessity of rapid intercommunication between armies, and between the individual units within each army.

The capacity for intercommunication has meant so much in the evolution of the military organism, and will certainly come in the future to mean so incalculably more, that it cannot be regarded as anything less than a master element in the shaping of its destiny.

But the destinies of the armies are dependent not only upon the activities in the sphere of operations, but also upon those in the service of supply. In this service, communications again exercise a controlling influence.

In a major emergency, involving the entire country, the United States itself may be regarded as a vast service of supply, and here again signal communications exercise a dominating influence upon the total military situation.

Had the late war continued for another year, it is safe to say that no activities in the United States would have been permitted that did not make, directly or indirectly, for the conduct of the war.

In an emergency threatening the national existence, the energies of the entire effective population should be directed to the winning of the war.

The effective population, according to this view, would be divided into two parts; those actually in the military and naval service and those not in the military and naval service, but engaged in operations necessary to the conduct of the war.

It does not follow from this that schools and theatres and moving picture shows should be prohibited, or that no form of amusement should be permitted. These, and many other things, are necessary that the national organism should be kept in a healthy condition, performing its function in the national defense, and that its morale should be sustained.

It does mean, however, that these and all other activities should have a new orientation; that everything which makes, directly or indirectly, for the successful conduct of the war should be promoted, and everything that makes against this should be discontinued.

Every citizen has responsibilities and duties to the country in time of peace. He also has duties and responsibilities in time of war. So far as engaging in actual military service, these duties are now well understood, and are defined or are capable of being defined by law.

For these duties, individuals prepare themselves by attendance at training camps, by study, and by various means which are becoming available to the patriotic citizen.

But there are other duties which our citizens have, in the event of war, aside from actual service in the Army or Navy. These duties are not so well understood, and they are not defined by law. In fact, I doubt if it is possible or desirable that they should be definitely embodied in statutes.

While our citizens have come to realize their individual responsibility for military service, they do not yet appreciate their individual, collective, and corporate responsibility in the performance of these other duties to which I have just referred.

Let me explain, for a moment, what I mean by these other duties:

A factory, let us say, engaged in time of peace in the manufacture of ornamental goods, is capable in time of war of manufacturing equipment of vital importance to the Army. This factory, whether owned by an individual, a firm, or a corporation, is an entity with an organization which has a peace-time function, as well as a potential war-time function.

To fulfill its duty to the nation, this entity should be prepared in advance so that it could fulfill its war-time function, whatever it might be, just in the same way that the individual citizen must be prepared to carry out his war-time function, if necessary, by performing such military service as might be assigned to him.

The modern conception of the national defense requires that we should educate not only our individual citizens in preparation for an emergency, but also our firms, our factories, and our corporations. They, too, should be prepared for the national defense by preliminary training and by continuous education.

An adequate program for the national defense requires that each firm or factory or corporation, without any exception, should know that it has war-time duties, and so far as it can be done in advance, they should be instructed in these duties.

Until these duties are known, and until preparation has been made for their performance, no army, however large, will be adequate for the national defense. Without such support, no commanding general, however great may be his military genius, and no body of men, however brave and well-disciplined they may be, can win the ultimate victory.

The individual citizen who is destined for the military service is removed from his civilian environment and placed under military control where he receives his military education and training and discipline. The United States Army has abundantly demonstrated its ability to effect the results aimed at by this training.

But it is not possible in just this way to train and discipline and educate firms and factories and corporations. They can not be segregated in training camps, and educated in the details of their business by military officers. They must remain where they are, and their functions are such that they can not be conducted by the military establishment according to the rules of war and under the army regulations.

The functions which they are to perform in time of war must be directed towards an end designated by the military authorities, but the method of functioning and the type of organization is that determined by the nature of the civilian organism, itself.

It would not be desirable, even if it were possible, to place all of these organizations in the hands of the military. They must, in time of war, be operated by their own personnel, whose activities are governed by the principles of the civil organization rather than the military.

Nevertheless, in the event of war, these activities have an ultimate military objective and must be oriented to the demands of the military situation.

One of the major problems of preparedness, therefore, is, in time of peace, to educate, train, and develop these civilian activities so that in the event of war they may be employed to the best advantage in the national defense.

Here lies one of our large problems, and a great step towards its solution consists in educating public sentiment to the truth of the proposition which I have just stated.

Gratifying progress has been made in this direction by the War Department, proceeding under the authority granted by the Act of Congress, June 4, 1920. The remarkable response to the call of the War Department in the Defense Day Tests is evidence of this.

Representatives of industry are cooperating in a great nation-wide movement to study how best to utilize, in case of a national emergency, the various agencies of manufacture and supply which abound in the United States. Many intricate questions have arisen and will continue to arise, but it is certain that out of all of the work that is being done, a plan for the best utilization of these agencies will be developed.

I will not undertake to discuss this supply and manufacturing problem in detail, for that would be beyond the scope of this article. I shall call attention, however, to one fact of fundamental importance.

It is essential that contracts be agreed upon, which will provide a sound and equitable basis for the purchase of supplies and for the placing of orders for manufacture.

In the making of such contracts, these considerations, I think, should govern:

War should be regarded as an occasion demanding service. Whoever takes a war order for the government, is undertaking to perform a service to the nation. This should be done, not in the spirit of a peace-time business venture, but as a war-time duty.

In order that it may perform in the best manner this war-time duty, the firm or individual or corporation must receive reasonable, just, and adequate compensation from the government. Otherwise the contract cannot be properly performed, and the interests of the government as well as of the contractor will suffer.

The compensation must not be excessive, nor should it be inadequate. The government should be just as much concerned to see that the payment is not too small, as it is to see that it is not too large.

The details of such contracts involve many difficulties, but if these principles are accepted in good faith, the problem is enormously simplified.

The two gentlemen pictured below were founders of the American Signal Corps Association in 1926. Major General Charles McK. Saltzman (left), then Chief Signal Officer, and Brigadier General John J. Carty, the first national president of the Association, saw the need for a communications organization. General Carty was the Chief Engineer of the AT&T during this period, and it may be interesting to note that he was the first member of the Signal Corps Reserve to be promoted to Brigadier General after outstanding service during World War I.



Industry vs. the Military

on the Manpower Market

EVERY CITIZEN IS VITALLY AFFECTED by the new reserve mobilization law recently adopted by Congress. Employers, military planners, and families with men of military age especially must understand how this plan works.

Designed to meet any pressing requirement for combat troops on the fighting fronts, the law naturally emphasizes the military's requirements. But, because most of their young male personnel is subject to the new law, employers must for their own protection educate themselves and their employees to this new program.

One of the most important features of the draft law is the provision assigning an eight-year military obligation. This is the cornerstone of the new defense concept. From now on, EVERY MAN WHO ENTERS THE ARMED FORCES FOR THE FIRST TIME BEFORE REACHING HIS TWENTY-SIXTH BIRTHDAY IS REQUIRED TO SPEND A TOTAL OF EIGHT YEARS IN A MILITARY STATUS. For a man to acquire this obligation, he must:

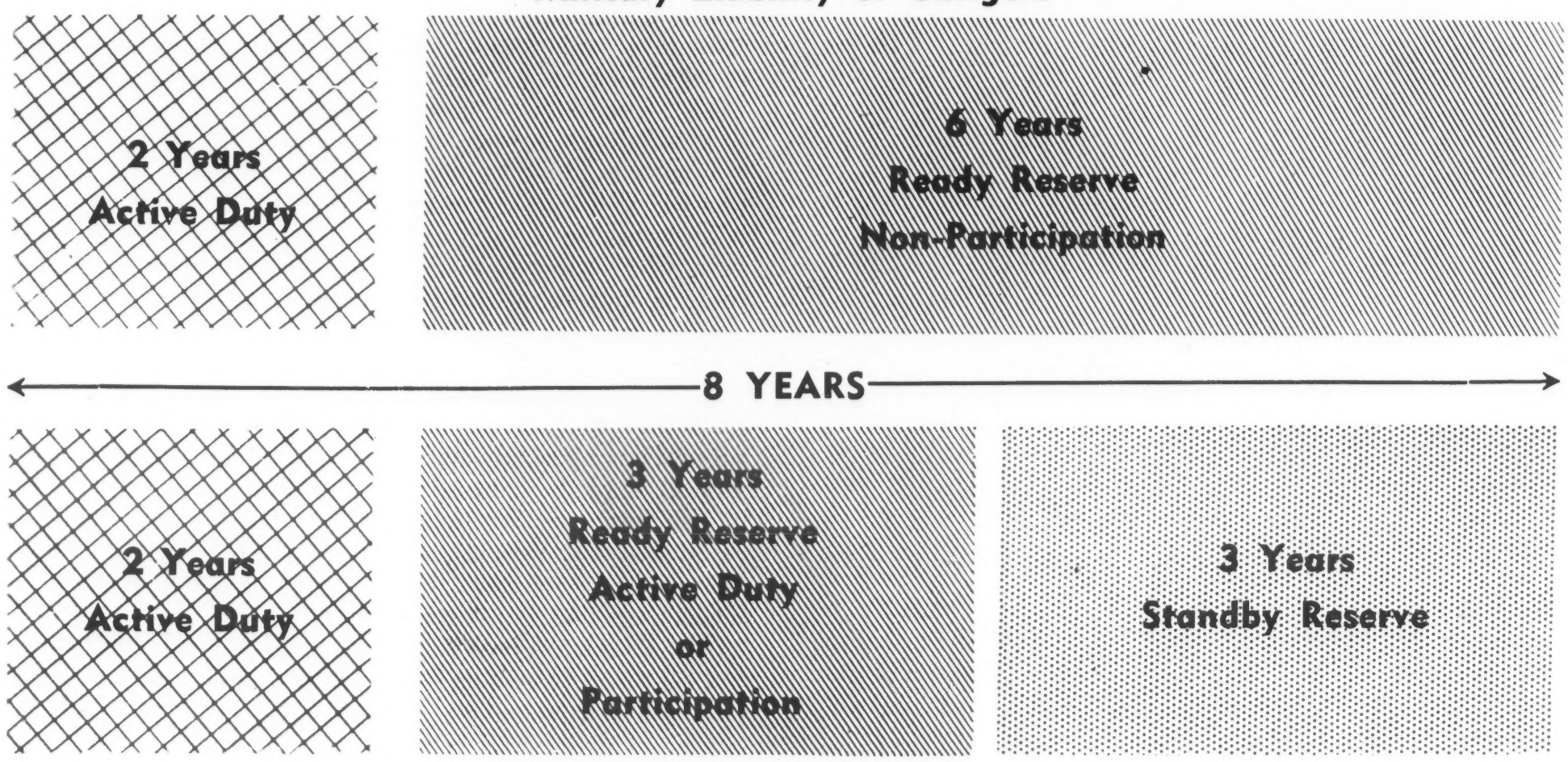
* Be initially enlisted, appointed, or inducted
* Into either the regular or reserve forces,
* After 19 June 1951, and
* Prior to attaining his 26th birthday.

The entire eight-year period does not have to be spent in active military service. Part of the time may be spent at home as a member of a reserve component.

Executives, supervisors, personnel men, foremen and straw bosses are speculatively eyeing next year's crop of high school and college graduates. Your organization may have several training programs available for them—to fill your expected needs for executive and administrative personnel and technicians. You may have a more immediate need for men as laborers.

In the past, it has been a relatively

Military Liability of Obligors



Industrialists must be aware of the new mobilization program outlined by Congress. Here is an explanation of how employers can best stabilize their working forces of draft-eligible personnel.

by Captain Burton P. Daugherty, Jr., USMCR

simple task to procure qualified personnel. Employers canvassed schools, interviewed prospective candidates, and took the best qualified men. Even with the draft taking big chunks out of the manpower market, this process suffered no great setback. Veterans seeking employment were matured by military service — they may have gained valuable experience. Most important, they were draft exempt.

Now this is changed. With the eight-year obligation, most prospective employees are veterans with a string attached to them. *They are liable to recall as reservists.*

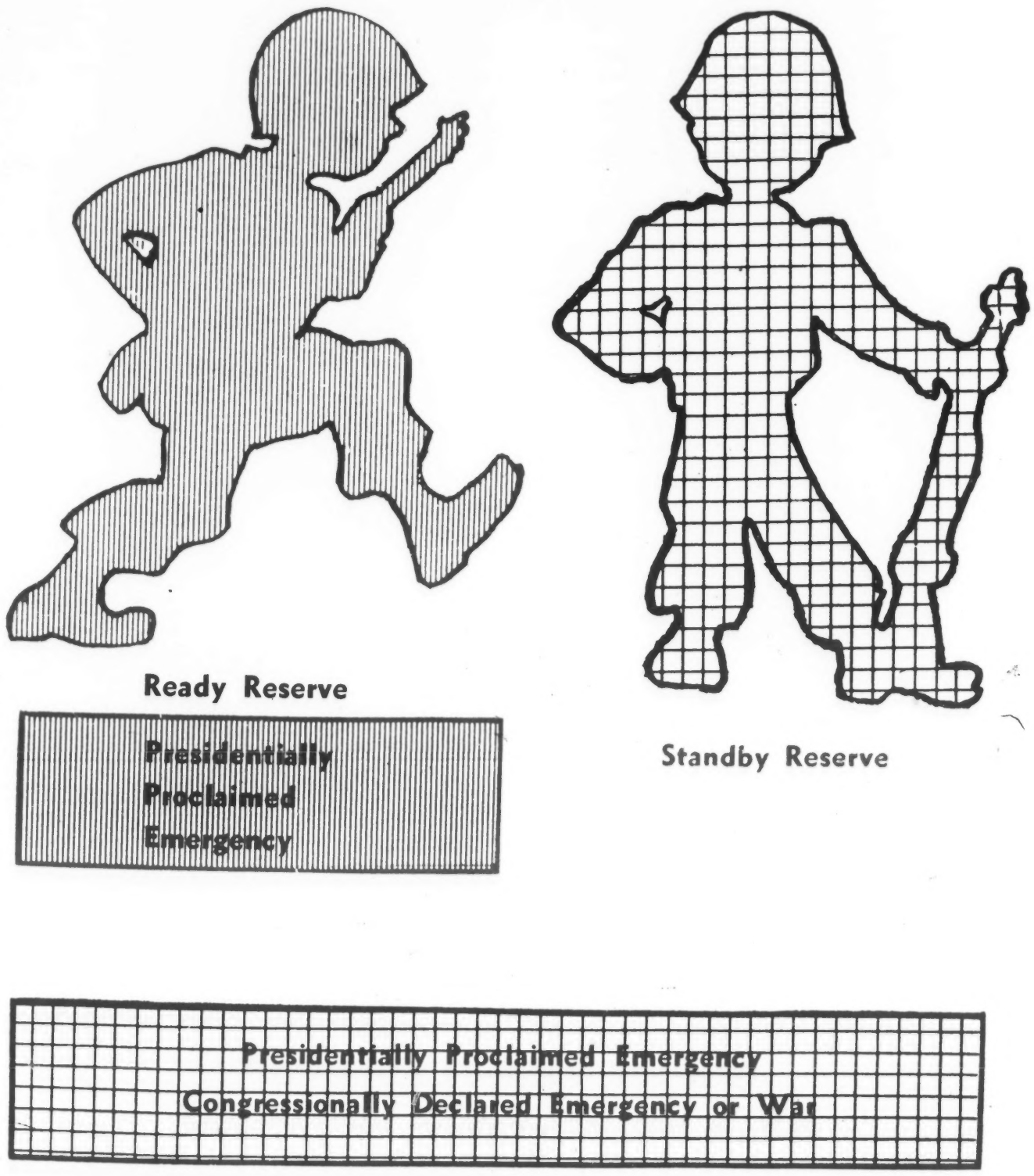
If you intend to engage in defense production during wartime, you will be competing with the military on the manpower market. And you will come to market with a thin purse. The scales are weighted because most of your prospective employees already are tied to the military. More simply, the military is permitted, by law, to have its thumb on the scales. After the typical inductee has been released from his two-year period of active duty, he still has six years to serve in the reserve.

Employers are now forced to adapt their planning to meet this situation. Two factors count on the employer's side, however. The first is a provision of the law dealing with any future recall of reservists, the other a Department of Defense regulation providing for recall-delay of key defense workers.

Obviously, the reserve forces will eventually be filled with thousands of

(*Continued on page 74, col. 3*)

Mobilization Categories for Reservists with Military Obligations under the Universal Military Training and Service Law





Another Photography FIRST

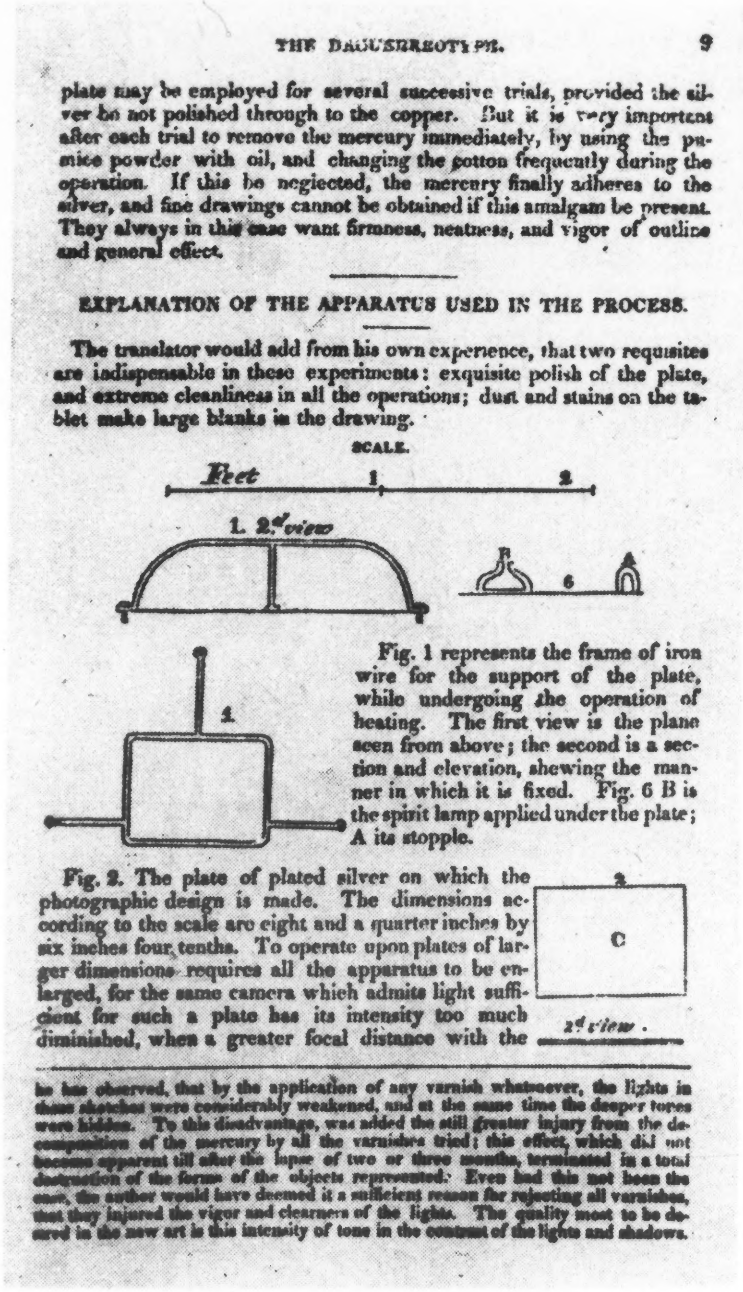
by Frank Smith

In publishing the first manual on photographic processes and techniques, an explanation of the Daguerre method, Dr. James R. Chilton made a great contribution to photography in America.

NOT LONG AFTER THE DAGUERREOTYPE PROCESS was disclosed by the French Government at a public meeting in Paris on August 19, 1839, a small group of scientifically and mechanically minded men in New York City at once constructed equipment, prepared plates and chemicals, and began experiments. These pioneers included Samuel F. B. Morse, portrait painter and inventor of the electric telegraph, John W. Draper, Professor of Chemistry at the University of the City of New York, Alexander S. Wolcott, instrument maker, James R. Chilton, and D. W. Seager. In making their first photographic trials, they followed the directions which Daguerre gave in one chapter of his book published in Paris. To Dr. Chilton belongs the honor of having published the first separate edition of these working instructions to appear in America.

Born in New York City in 1808, he was a practicing physician and chemist of note when the first news of Daguerre's invention crossed the Atlantic. He subsequently opened one of the first supply houses for photographic materials, and it is said that he backed Edward Anthony in his first commercial venture in that field. He also took daguerreotype portraits.

The manual which he published, an illustrated pamphlet of 16 pages, has only recently come to light. It is titled *Full Description of the Daguerreotype Process as Published by M. Daguerre*, and bears the imprint New York, For Sale by J. R. Chilton, 1840. The only copies thus far located are in the Library of the U. S. Patent Office, in the George Eastman House, and in the collection of Alden Scott Boyer of Chicago. The text is reprinted from the periodical *American Repertory Arts, Sciences and Manufactures* for March, 1840. This was not the first time that Daguerre's work had been published in America; already the *Journal of the Franklin Institute*, in its November, 1839, issue had brought its readers a translation from the pen of Professor J. W. Frazer of the University of Pennsylvania, and the *New York Observer* gave over the entire back page of its November 2 issue for a complete reprint of an English translation which had just arrived from London on the crack steamer *Liverpool*. But Dr. Chilton's book was the first time that the text was available in separate form.



THE DAGUERREOTYPE. 9

plate may be employed for several successive trials, provided the silver be not polished through to the copper. But it is very important after each trial to remove the mercury immediately, by using the pumice powder with oil, and changing the cotton frequently during the operation. If this be neglected, the mercury finally adheres to the silver, and fine drawings cannot be obtained if this amalgam be present. They always in this case want firmness, neatness, and vigor of outline and general effect.

EXPLANATION OF THE APPARATUS USED IN THE PROCESS.

The translator would add from his own experience, that two requisites are indispensable in these experiments: exquisite polish of the plate, and extreme cleanliness in all the operations; dust and stains on the tablet make large blanks in the drawing.

SCALE.

Feet 1 2

1. 2d view

B 6

Fig. 1 represents the frame of iron wire for the support of the plate, while undergoing the operation of heating. The first view is the plane seen from above; the second is a section and elevation, shewing the manner in which it is fixed. Fig. 6 B is the spirit lamp applied under the plate; A its stopple.

Fig. 2. The plate of plated silver on which the photographic design is made. The dimensions according to the scale are eight and a quarter inches by six inches four tenths. To operate upon plates of larger dimensions requires all the apparatus to be enlarged, for the same camera which admits light sufficient for such a plate has its intensity too much diminished, when a greater focal distance with the

2 C

2d view.

he has observed, that by the application of any varnish whatsoever, the lights in these sketches were considerably weakened, and at the same time the deeper tones were hidden. To this disadvantage, was added the still greater injury from the decomposition of the mercury by all the varnishes tried; this effect, which did not become apparent till after the lapse of two or three months, terminated in a total destruction of the forms of the objects represented. Even had this not been the case, the author would have deemed it a sufficient reason for rejecting all varnishes, that they injured the vigor and clearness of the lights. The quality most to be deserved in the new art is this intensity of tone in the contrast of the lights and shadows.

This article first appeared in *Image*, Journal of Photography of the George Eastman House. Photographs are from the Technical Library of the U. S. Patent Office.

Of even more interest than Daguerre's text are the editorial additions. An exposure table, prepared by D. W. Seager, may well be the earliest ever to be printed. It shows exposures varying from 5 minutes to 1 hour and 10 minutes! Already the first photographers were making improvements. "The preceding pages describe fully the process of Daguerre," the editor states. "It could not, however be supposed that the peculiar spirit of American enterprise would rest satisfied with this; and, accordingly, no sooner had those engaged in the experiments fully satisfied themselves that the process was practically given, than they almost immediately conceived it possible to effect similar results by more simple and less expensive means."

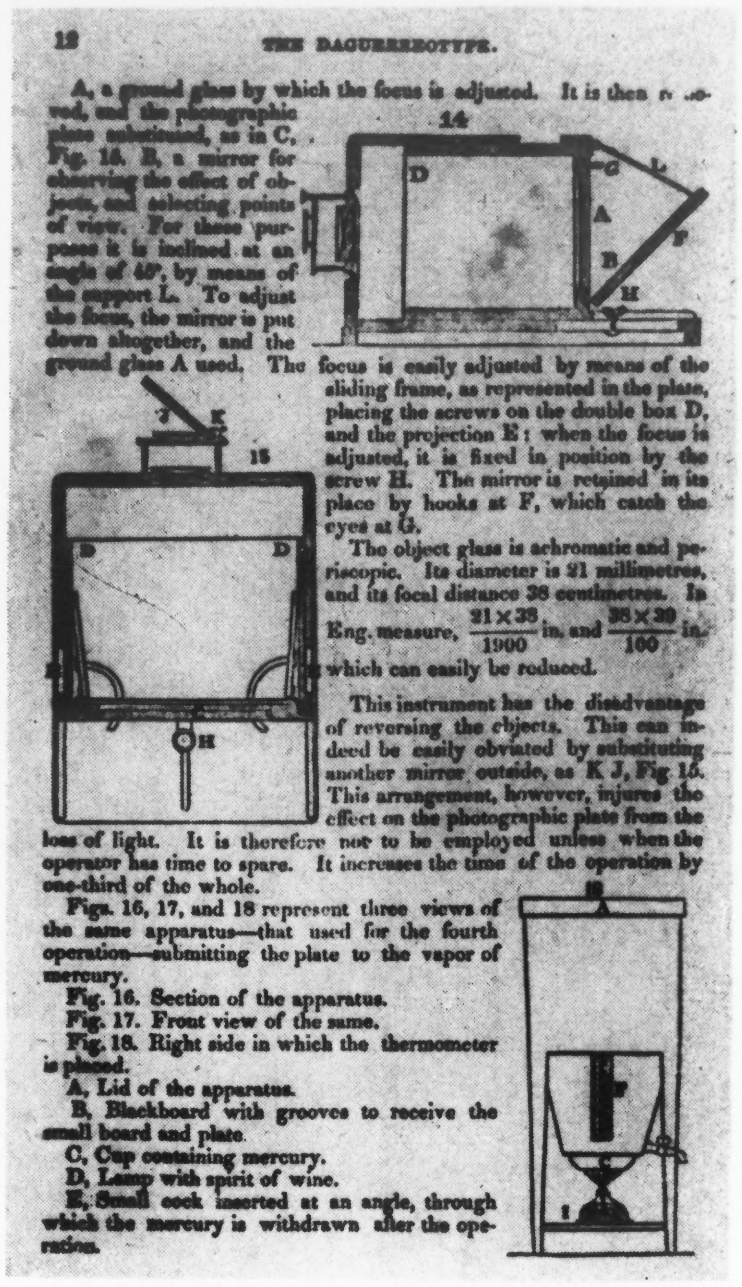
Four improvements are noted: the substitution of a single meniscus lens for the costly combination of Daguerre; dispensing with the use of nitric acid; polishing the plate with rotten stone; and the substitution of a shallow iodizing box for the deeper one of Daguerre, thus shortening the time required to sensitize the silvered copper plate. Truly, Yankee ingenuity was working fast during those first few months of photography in America.

STATE OF THE WEATHER.	HOURS OF THE DAY.						
	8	9	10	11 to 1	1 to 2	2 to 3	3 and after
Very brilliant and clear, wind steady from W. or N. W., very deep blue sky, and absence of red rays at sunrise or sunset. Time employed	15 MINUTES.	8 MINUTES.	6 MINUTES.	5 MINUTES.	6 MINUTES.	7 MINUTES.	12 to 30 MINUTES.
Clear, wind from S. W., moderately cold, but a slight perceptible vapor in comparison with above. Time employed	16	12	7	6	7	8	15 to 40
Sunshine, but rather hazy, shadows not hard, nor clearly defined. Time employed	25	18	14	12	14	16	25 to 40
Sun always obscured by light clouds, but lower atmosphere, clear from haze and vapor. Time employed.	30	20	18	16	15	20	35 to 50
Quite cloudy, but lower atmosphere, free from vapors. Time employed	50	30	25	20	20	30	50 to 70

"Table of General Rules. For exposure of the plate in the camera, in taking exterior views." So reads the caption for this table in the manual compiled by Dr. Chilton. The exposure table had been prepared in New York by D. W. Seager.

Besides this publication of Chilton's, another photographic manual, not dissimilar, was published in Boston at almost the same time. It is titled *Description of the Daguerreotype Process;* or, *A Summary of M. Gourand's Public Lectures, according to the principles of M. Daguerre,* and bears the imprint of Dutton and Wentworth, Boston 1840. It is a resumé, rather than a translation, of Daguerre's instructions. The author, François Gouraud, had come to this country from France to peddle daguerreotype apparatus, and conducted public demonstrations in New York, Providence, Boston, and Niagara Falls. The George Eastman House has a complete daguerreotype outfit which he sold to Samuel Bemis in Boston on April 15, 1840. The exact date when his booklet was printed is not known: certainly it must have appeared after March 25, 1840, for an advertisement from a Boston newspaper of that date is reprinted in the text.

If Chilton acted with the characteristic Yankee speed of the day, it would not at all be improbable that he published Daguerre's manual immediately or shortly after its appearance in the *American Repertory* of March. If this assumption is correct, then Chilton should be credited with having published the first separate book on photography in America, thereby starting a long line of literature that was to follow.


12 THE DAGUERREOTYPE.

A, a ground glass by which the focus is adjusted. It is then removed, and the photographic plate substituted, as in C, Fig. 14. B, a mirror for observing the effect of objects, and selecting points of view. For these purposes it is inclined at an angle of 45°, by means of the support L. To adjust the focus, the mirror is put down altogether, and the ground glass A used. The focus is easily adjusted by means of the sliding frame, as represented in the plate, placing the screws on the double box D, and the projection E; when the focus is adjusted, it is fixed in position by the screw H. The mirror is retained in its place by hooks at F, which catch the eyes at G.

14

15

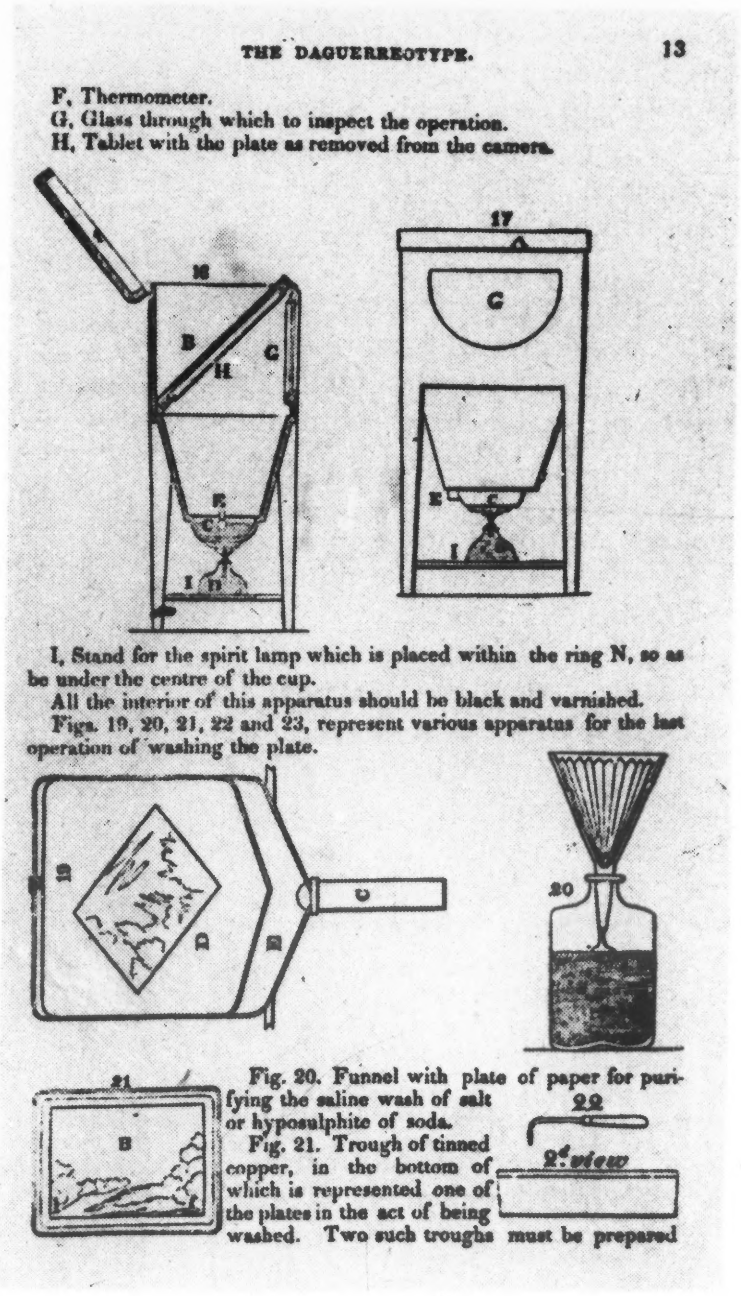
The object glass is achromatic and periscopic. Its diameter is 21 millimetres, and its focal distance 38 centimetres. In Eng. measure, $\frac{21 \times 38}{1900}$ in. and $\frac{38 \times 20}{100}$ in. which can easily be reduced.

This instrument has the disadvantage of reversing the objects. This can indeed be easily obviated by substituting another mirror outside, as K J, Fig 15. This arrangement, however, injures the effect on the photographic plate from the loss of light. It is therefore not to be employed unless when the operator has time to spare. It increases the time of the operation by one-third of the whole.

Figs. 16, 17, and 18 represent three views of the same apparatus—that used for the fourth operation—submitting the plate to the vapor of mercury.

Fig. 16. Section of the apparatus.
Fig. 17. Front view of the same.
Fig. 18. Right side in which the thermometer is placed.
A, Lid of the apparatus.
B, Blackboard with grooves to receive the small board and plate.
C, Cup containing mercury.
D, Lamp with spirit of wine.
E, Small cock inserted at an angle, through which the mercury is withdrawn after the operation.

Pages from the 16-page manual are reproduced from photostat copies of the book to demonstrate the thoroughness of Dr. Chilton in explaining the Daguerre techniques.


THE DAGUERREOTYPE. 13

F, Thermometer.
G, Glass through which to inspect the operation.
H, Tablet with the plate as removed from the camera.

I, Stand for the spirit lamp which is placed within the ring N, so as be under the centre of the cup.
All the interior of this apparatus should be black and varnished.
Figs. 19, 20, 21, 22 and 23, represent various apparatus for the last operation of washing the plate.

Fig. 20. Funnel with plate of paper for purifying the saline wash of salt or hyposulphite of soda.
Fig. 21. Trough of tinned copper, in the bottom of which is represented one of the plates in the act of being washed. Two such troughs must be prepared

SKILL Gets the Mes

THE SIGNAL CORPS RIGHTFULLY prides itself in being able "to get the mesage through." To the average observer this seems to be a simple enough operation. However, if he stops to think for a moment or two, he realizes the vast amount of technical training necessary to accomplish this mission.

While reflecting on this training, he discovers that the foundation for "getting the message through" really rests with the skill of the instructor. The true concept of instructional skill implies two attributes—speed and accuracy. In order to accomplish these attributes the teacher must have a thorough understanding of his responsibilities to his students and to himself, if he is to train technicians in the shortest possible time.

The teacher of today must have the quality of greatness. It must be real, it must be rooted in the character of the man. "He is great," said Emerson "who is what he is by Nature." And the teacher of today can be great only if there is in him the stuff of greatness—simple honesty, simple integrity.

The demands imposed upon teachers by the fast moving technological development of our day have altered the conditions of teaching. But the art of teaching is untouched by these. The art of the teacher, grown out of the demands imposed upon him by human needs, remains essentially what it has always been.

This idea can be expressed another way by saying that the teacher of today must not only be well-groomed in the "3R's," but also in the "X" of the human equation. He must have a keen interest in people, he must be dedicated to the task. The human equation is the most critical task that teacher has to face. It involves the fostering of good faith between the student and himself.

This is why certain teachers stand out in memory beyond all the others. I can well remember my Latin teacher. He was distinguished in appearance; he has eyes that were full of diamonds, a fine face, a melodious voice. And he knew and loved Latin. But best of all he had integrity. And without this quality our whole teaching system will break down.

Another instructor comes to mind . . . that kindly character in "Goodbye, Mr. Chips." He typifies that grand old teacher whose only purpose for being was to teach, to share his knowledge with others. And he, too, had integrety rooted in his very being and even sought to transmit that to his boys.

I remember still another teacher. This was a corporal assigned to this post, who is, in civilain life, a teacher in one of our finest colleges in the East. I asked him to search his past for the teacher who had helped him the most, and by way of reply, he made this observation, that "the teacher who helps anybody most is clear, lucid, and explicit in all his lectures." He also said, what left upon me a very deep impression, "that a teacher must respect the individual rights of the student."

This last comment goes back to the philosophy of conduct implied in the "X" of the human equation; namely, good human relations. If a teacher once violates this concept he has lost a student; and there is little chance from then on for meeting of the minds of teacher and student; what is more, that student may go into his "shell" and find outlets in other than educational pursuits.

The teacher has to play many roles to many people at the same time. He has to be a well informed instructor one minute and a father-confessor or human relations counselor the next. And he will be judged on his ability to play each role well.

Let us discuss some of the finer qualities which a teacher has to possess in order to qualify as an outstanding teacher. These qualities may not be disclussed in any order of significance but should be included in any list.

Vitality, energy, and enthusiasm for the job of teaching should be mentioned. If a person has a zest for his job it will show, and his students

Development of technically competent Signalmen is the objective the teacher must always keep in mind in training instructors for The Signal School at Fort Monmouth. Major Elbert R. Moses, Jr. (right), author of this article, emphasizes to Pvt. Herbert E. Phillips that "Technical Competence" and "Teaching Ability" are qualities that must always be kept in balance. Major Moses, who was Chief of the Instructor Training Branch for The Signal School until recently, has now returned to his position as Associate Professor of Speech at Eastern Illinois State College.



sage Through

by Major Elbert R. Moses, Jr., SigC
Former Chief, Instructor Training Branch
Fort Monmouth, New Jersey

will respond. One has to have an enthusiasm which is spontaneous and which comes from the heart. It has to be genuine. This enthusiasm has to be of the infectious variety which will stimulate and encourage students.

Sincerity and integrity are listed because it is an outrage against good educational principles to stand up before a class without these qualities. I once knew a professor who used his position to change the unmoulded college freshman mind on the subject of religion. This person was not sincere in his efforts but perpetrated dialetic discussions for the purpose of amusement. Again, we might have a teacher who may distort the facts or plagiarize to suit his own ends.

The next group of qualifications come under the fourth "X" factor of the human equation; good-human relations. I am including such qualities as warmth, regard for the dignity of the student, a sense of humor which includes knowing when to use it, and the recognition of the quality which invokes neither sarcasm nor ridicule.

The folowing are the qualities of an excellent instructor; confidence, poise, power of expression—grammatical as well as oral, and a good classroom personality and technical competence.

Thse qualities may get one into trouble if he does not balance them with what one might call "technical competence." On the other hand, if one has the technical know-how and can not share his knowledge, he will not be accepted as a good teacher.

There is another quality, an additional sense, which some few instructors possess to a greater or lesser degree. This is a certain intuitive "feel" for the clas which tells them when to have a discussion, a lecture. or when to have an application or demonstration. This is something that is not learned out of books, and some teachers never learn it. Some teachers never learn when their subject is getting across. That is probably the reason some never get a "charge" or "bang" out of teaching. Yet, this is the teacher's real recompense; one cannot measure it in dollars and cents.

Personal appearance should not be taken for granted in a civilian or military situation; it should be stressed that a teacher be neat and dressed in good taste. If he wears too much "fruit slaad" (in the military situation) there might be a tendency on the part of some students to spend some time trying to figure out what each ribbon stands for.

As I conclude this list there is one more quality which comes to my mind and that one is loyalty. This means loyalty to one's superior and particularly to oneself. It is an overall quality which the good instructor has. It carries with it the thought that you must be true to yourself and then you can be true to others.

It is possible that each of you has had at least one teacher, who stands out above all the others. You may be hard pressed to know why you liked him, but there was something distinctive about him; some quality which brought him into tune with your personality and, of course, your thinking. Could this quality have been integrity to the point of greatness?

But to say this is not to argue that even the great teachers of thirty years ago would in our circumstances carry the torch so effectively and well. The teacher of today must be great in his understanding of a world which is in turmoil and which at the same time is pushing the borders of human knowledge almost to the starts. The teacher of today must be great in his knowledge of today's world, today's perilous problems, today's gigantic achievements. The point is, though, that he cannot be great by this means alone. He must be great first in the way those other teachers were great, and to their greatness he must add a special greatness which is peculiarly of this day and his.

This is a tall order, perhaps. But this is what the situation calls for. A stiuation bought about because of the ne ed for the expert handling of the intricate operations as in the submarine and airplane. The need for well trained crews operating as one man. When a submarine is submerging there is no time to wait for that flash of genius which will tell you what to do. That crew has been made ready only by constant repetition of each tiny opeartion, which in turn, has lead to the acomplishment of the big operation. And some very careful, painstaking teaching went into the training of this select crew to help them acquire skill and competence.



The quality of visual training aids for use in the classroom is pointed out by Dr. Frank, Acting Chief of the Instructor Training Bureau.

Teaching calls for persons dedicated to the cause of teaching and who possess character above reproach. It wil take a thoughtful and purposeful person to realize that the batles of tomorrow and "the production of better things for better living" will be won or lost in the classrooms and laboratories of today. The teacher in our time will need the abiltiy to accept criticism in order to grow and develop in his role as a teacher. In short, it will take a great man to be a great instructor in this extensive and expansive technological age; and the "mesage will get through" if the proper skill and training have been applied.



From the President

President Redman says, "Communication is one of the most essential components of an adequate Civil Defense system." In emphasizing this he makes us, as AFCA members, aware of our responsibility to our nation and to our communities.

As members of the AFCA, we have pledged ourselves to the defense of our nation. With our energies and talents, we contribute to this defense by our inventive, engineering and manufacturing endeavors. In both the Services and Industry, we are approaching our goal of mutual understanding so necessary for the defense effort.

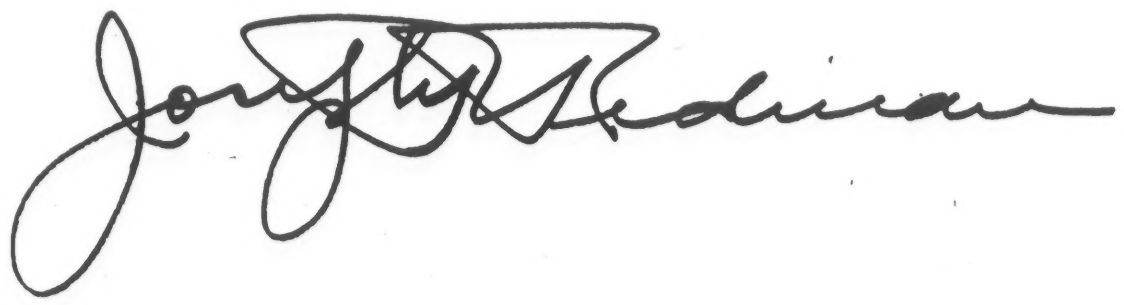
But there is one important part of our security which, to this time, has not been given proper recognition—*Civil Defense*—the responsibility of each of us. The Civil Defense program, as outlined by the Federal Civil Defense Agency, is an ambitious one. But without the cooperation of every citizen, the program cannot be successful and effective.

Communication is one of the most essential components of an adequate Civil Defense system. Since, as communicators and electronic engineers, we have a working knowledge of equipment used, we owe it to our nation to give our time and experience to educate others in the use of the equipment and how to maintain and service it. We also would be helpful in organizing local systems by offering technical assistance in the solution of complex problems and in the selection and installation of communication equipment.

As a group, chapters should arrange to participate in the Ground Observer Corps activities. This is a very necessary service and one weak link in the network is a danger spot. As yet, the public fails to realize its vital importance.

Amateur operators, with their fixed and mobile units, are a vital part of the system. They have always rendered invaluable service in any national emergency. The AFCA could well take a leaf out of the book of ARRL.

Through technical assistance and civic cooperation, we can render inestimable service to our National Security through Civil Defense. Let our "actions speak louder than words."



Association Affairs

CONVENTION PLANS PROGRESS

Colonel Percy G. Black, chairman of the 1954 AFCA Convention, has announced that plans for a tour of the Naval Ordnance Laboratory, White Oak, Maryland, have been made. The visit will take place on Friday, May 7th, the second day of the three-day meeting to be held at the Shoreham Hotel in Washington, D. C.

Arrangements have been made for bus transportation between the Shoreham and the Laboratory, and luncheon will be available there for the members and guests of the Association. The tour will involve unclassified materials and areas at NOL, and heavy equipment furnished by other departments of the Navy, the Army and Air Force will be set up on the grounds of the Laboratory.

School Changes Name

Central Radio and Television Schools of Kansas City, Mo. has officially changed its name to Central Technical Institute. The change in name was announced following a recent meeting of the school's Board of Directors in Kansas City.

In outlining the reasons for the change, C. L. Foster, President of the school, pointed out that the name Central Technical Institute would indicate more clearly to the general public the scope and nature of the school's educational programs.

In addition to its technical training division, Central will continue to operate its training programs for Airline personnel under the title of "Airline Training Division of Central Technical Institute."

New G E Department Headed By General Rives

Expanding research and development activities of the General Electric Electronics Division have resulted in the creation of a Laboratories Department within the Division, it was announced recently. Brig. Gen. Tom C. Rives (ret) has been appointed manager of the new department which includes the Electronics Laboratory at Syracuse and the Advanced Electronics Center at Cornell University. (See story of the Center on page 23.)

Franklin Institute Awards Ballantine Medal

On October 21, 1953 Dr. David G. C. Luck of RCA Laboratories received the Stuart Ballantine Medal of The Franklin Institute of the State of Pennsylvania. Dr. Luck was awarded the medal "For his invention of the Omnidirectional Radio Range, an essential element in present day air traffic control," as reads the citation accompanying the award. Presentation of the medal was part of the Medal Day ceremonies held annually at The Franklin Institute.





AFCA Director Appointed To Head Bomb Defense Study

The appointment of Robert C. Sprague by the Senate Armed Forces Sub-Committee on Preparedness to direct a full-scale study of hydrogen and atomic bomb defense was announced on October 10 by Senator Leverett Saltonstall (R. Mass.), head of the committee.

Mr. Sprague is well-known throughout the electrical and electronic industries as chairman of the board of the Sprague Electric Company, North Adams, Mass. and also for his untiring efforts on behalf of the Radio-Electronic-Television Manufacturers' Association of which he was formerly president and is now chairman of the board.

In announcing Mr. Sprague's appointment, Senator Saltonstall said the Senate Committee had decided that the highly technical problem of guarding against bomb attack must be reduced to lay terms in order that the members themselves could better understand the ramified details which face the nation in preparing its defenses.

Eastern Joint Computer Conference Announced

"Information Processing Systems —Reliability and Requirements," is the general theme of the Eastern Joint Computer Conference and Exhibition sponsored by the Institute of Radio Engineers, the Association for Computing Machinery and the American Institute of Electrical Engineers to be held in Washington, D. C. on December 8th, 9th and 10th at the Statler Hotel. Speakers include: Dr. Harold T. Engstrom, Remington Rand; Mr. John H. Howard, Burroughs Corp.; Mr. Joseph Samgorinsky, U. S. Weather Bureau; J. A. Goetz and H. J. Geisler, IBM; and many other distinguished specialists in the field.

NEW POSITION FOR GENERAL SANDRETTO



The appointment of Brig. General Peter C. Sandretto, U.S. A.F.R., as Technical Director of the Federal Telecommunication Laboratories, Nutley, N. J., a division of International Telephone and Telegraph Corporation, was announced recently. He was formerly Assistant Technical Director.

General Sandretto, an active AFCA member, joined the International Telephone and Telegraph Corporation in 1946 and has since served in key executive positions in the IT&T System in the field of Aeronautical Radio Engineering, including that of Director of Aviation of the International Telecommunication Laboratories. He was appointed Assistant Technical Director of Federal Telecommunication Laboratories in 1948.

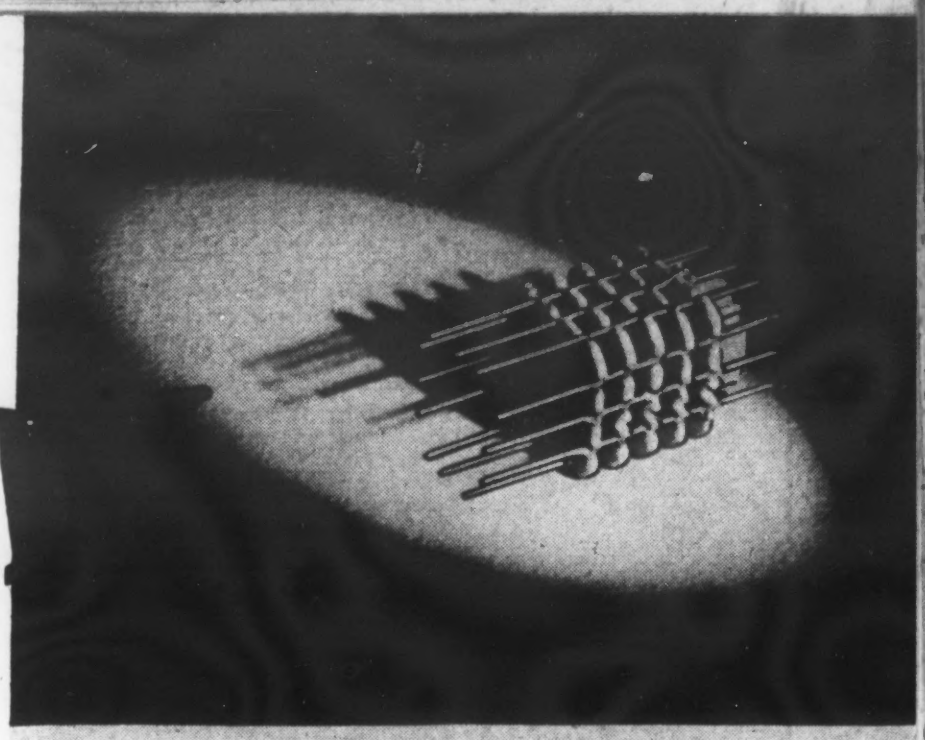
AFCA Group Members

Communications—Electronics—Photography

Listed below are the firms who are group members of the Armed Forces Communications Association. By their membership they indicate their readiness for their share in industry's part in national security. Each firm nominates several of its key employees or officials for individual membership in AFCA, thus forming a group of the highest trained men in the electronics and photographic fields, available for advice and assistance to the armed services on research, development, manufacturing, procurement, and operation.

Acme Telectronix
Admiral Corporation
Air Marine Motors, Inc.
Allied Radio Corporation
Almo Radio Company
Altec Lansing Corporation
American Cable & Radio Corp.
American Institute of Electrical Engineers
American Machine & Foundry Co.
American Phenolic Corporation
American Radio Relay League
American Telephone & Telegraph Co.
Ampex Electric Company
Anaconda Wire & Cable Company
A. R. F. Products, Inc.
Argus Cameras, Inc.
Arnold Engineering Company
Atlas Precision Products Co.
Audio Products Corporation
Automatic Electric Company
Automatic Electric Sales Corp.
Baltimore News Post
Barry Corporation, The
Bell Telephone Company of Pa.
Bendix Radio
Bliley Electric Company
Breeze Corporations, Inc.
Burnell & Company
California Water & Telephone Co.
Cambridge Thermionic Corp.
Capitol Radio Engineering Inst., Inc.
Cargo Packers Inc.
Carolina Telephone & Telegraph Co.
Central Radio and Television Schools
Chesapeake & Potomac Tel. Co.
Churchill Cabinet Co.
Cincinnati & Suburban Bell Tel. Co.
Collins Radio Company
Columbus Process Co., Inc.
Copperweld Steel Company
Cornell-Dubilier Electric Corp.
Crosley Division-Avco Mfg. Corp.
De Vry Corporation
Diamond State Telephone Co.
Downing Crystal Company
Dukane Corporation
DuMont, Allen B., Laboratories, Inc.
Eastern Air Devices, Inc.
Eastman Kodak Company
Electronic Associates, Inc.
Elgin Metalformers Corporation
Espey Manufacturing Co., Inc.
Federal Mfg. and Engineering Corp.
Federal Telephone & Radio Corp.
General Aniline & Film Corp.
General Cable Corporation
General Communications Co.
General Electric Company
General Insulated Wire Works, Inc.
General Telephone Corp.
General Transformer Co.
Gilfillan Bros., Inc.
Globe Wireless, Ltd.
Graflex, Inc.
Gray Manufacturing Co.
Guardian Electric Mfg. Co.
Hallicrafters Company
Haloid Company
Hammarlund Manufacturing Co., The
Hazeltine Electronics Corp.
Heinemann Electric Company
Hercules Motor Corp.
Hoffman Laboratories Incorp.
Hughes Aircraft Company
Hycon Manufacturing Company
Illinois Bell Telephone Co.
Indiana Bell Telephone Co.
Institute of Radio Engineers
Indiana Steel & Wire Co.
International Business Machines
International Resistance Co.
International Tel. & Tel. Corp.
Jacobsen Manufacturing Co.
Kellogg Switchboard & Supply Co.
Kleinschmidt Laboratories, Inc.
Lavoie Laboratories
Leich Sales Corporation
Lenkurt Electric Company, Inc.
Lenz Electric Manufacturing Co.
Lewyt Corporation
Loral Electronics Corporation
Machlett Laboratories, Inc.
Magnavox Company
Majestic Radio & Television, Inc.
Mallory, P. R., & Co., Inc.
Merit Coil and Transformer Corp.
Michigan Bell Telephone Company
The Montgomery Company
Motorola, Inc.
Mountain States Tel. & Tel. Co.
Muter Company, The
National Cash Register Co.
National Company, Inc.
Nelson Technical Enterprises
New England Tel. & Tel. Co.
New Jersey Bell Telephone Company
New London Instrument Co.
New York Telephone Company
Northwestern Bell Telephone Co.
Oak Manufacturing Co.
Ohio Bell Telephone Co.
O'Keefe & Merritt Company
Pacific Mercury Television Mfg. Corp.
Pacific Telephone & Telegraph Co.
Phebco, Inc.
Philco Corporation
Photographic Society of America
Pickering & Company, Inc.
Pioneer Electric & Research Co., The
Platt Electronics Corporation
Precision Apparatus Co., Inc.
Radiart Corporation
Radio Condenser Company
Radio Corporation of America
RCA Victor Division
Radio Receptor Company
Raymond Rosen Engineering Products, Inc.
Ray-O-Vac Company
Raytheon Manufacturing Company
Red Bank Division
Bendix Aviation Corp.
Reeves Instrument Corp.
Remington Rand, Inc.
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Pilot International Corp.
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Stackpole Carbon Company
Standard Coil Products Co., Inc.
Standard Piezo Co.
Standard Research Institute
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Stupakoff Ceramic & Mfg. Co.
Sylvania Electric Products, Inc.
Talco Engineering Co., Inc.
Technicolor Motion Picture Corp.
Telephone Services, Inc.
Telephonics Corporation
Teletype Corporation
Times Facsimile Corporation
Transmitter Equipment Mfg. Co.
Trav-ler Radio Corp.
Triad Transformer Corp.
Tung-Sol Lamp Works, Inc.
United States Rubber Company
United Telephone Co.
Utah Radio Products Co., Inc.
Voltz Brothers, Inc.
Waterman Products Co., Inc.
Wells Sales, Inc.
West Coast Telephone Co.
Western Electric Company, Inc.
Western Union Telegraph Co.
Westinghouse Electric Corp.
Weston Electrical Instrument Corp.
Whitney Blake Co.
Wickes Engineering & Construction Co.
Willard Storage Battery Company
Wisconsin Telephone Company
Wollensak Optical Company
York-Hoover Corporation
Zenith Radio Corporation

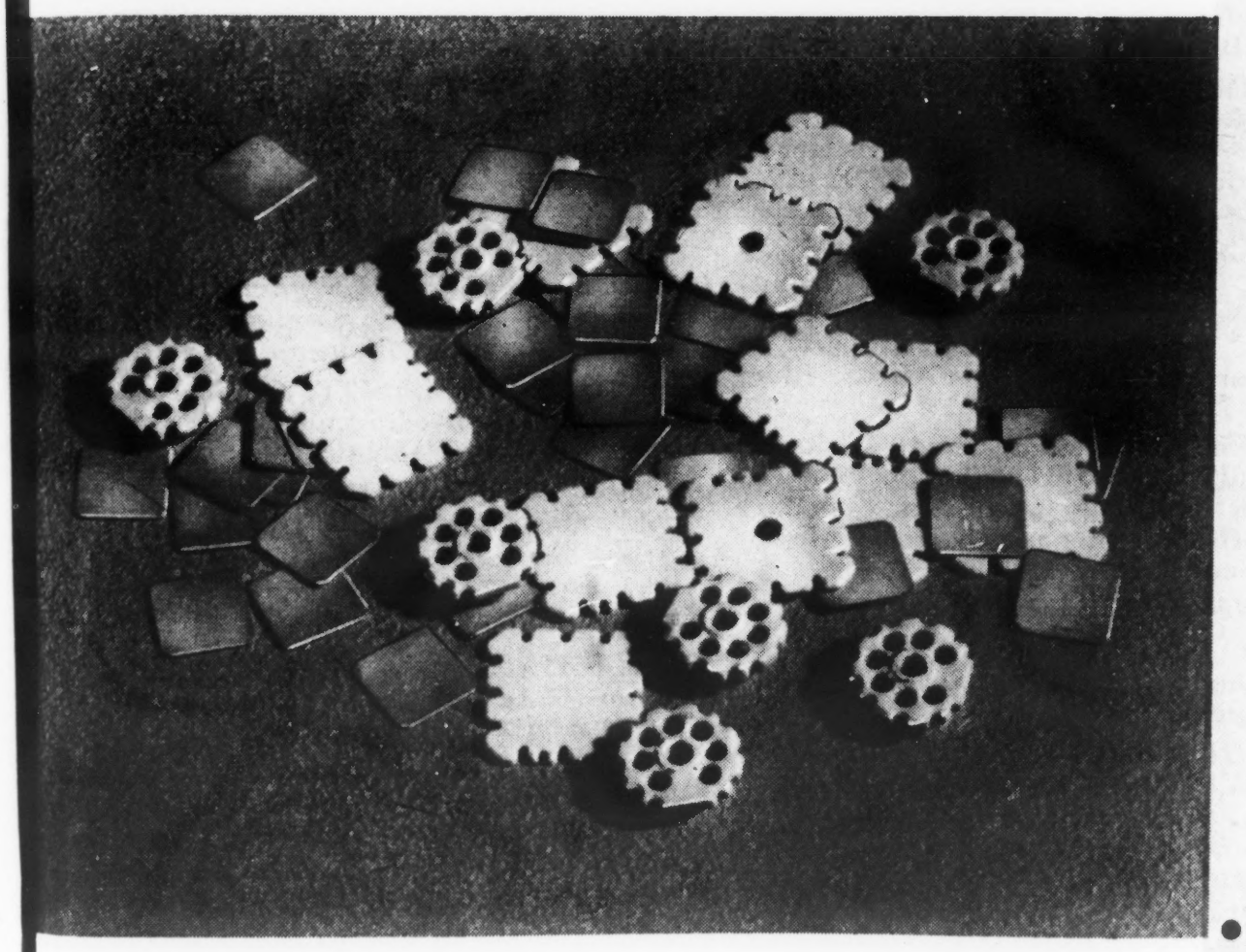
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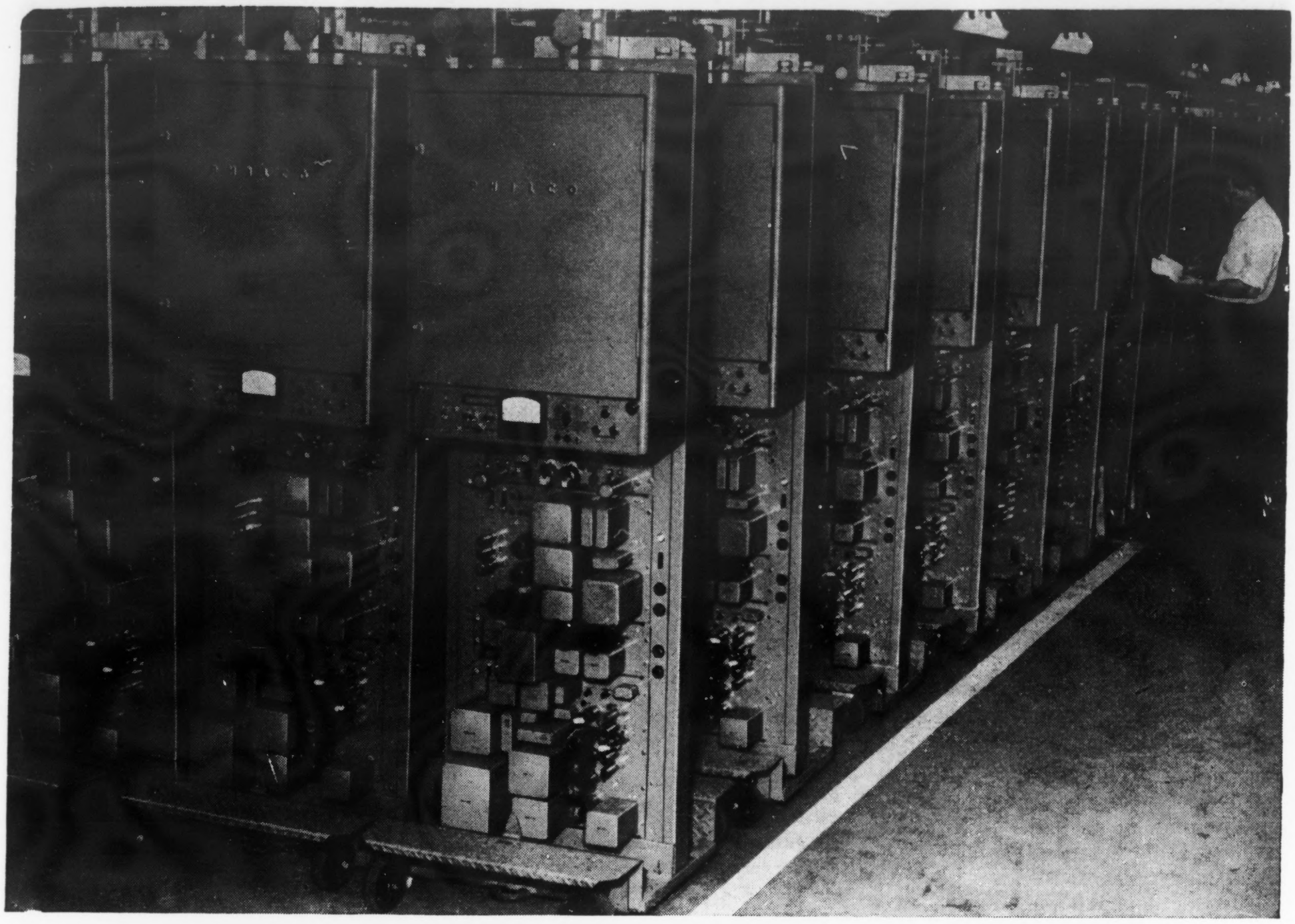
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Chapter News

1953 Chapter of the Year—Augusta-Camp Gordon

Atlanta

Lt. General Manton S. Eddy, USA (ret.), who commanded the 9th Infantry Division throughout the North African, Sicilian and Normandy campaigns, was guest speaker at the joint meeting of the Atlanta AFCA Chapter and the local unit of the Military Order of World Wars on September 24th. He was introduced by Gen. Edward T. Williams, his former chief of staff.

Discussing the military situation in Europe, General Eddy pointed out that the attitude of the American people had undergone a great change since the end of World War II—wishful thinking and complacency had given way to the realization of the threat of communism towards domination of the world. He felt the intervention in Korea was a magnificent demonstration of faith and would pay great dividends.

After a detailed appraisal of the military, industrial and political strength of the USSR, General Eddy went on to evaluate the possibilities of World War III. He praised the foresight of American leaders and of the National Security Council. He also praised the work of the NATO, the Marshall Plan and the Military Assistance Program, pointing out that in 1950 the force in Europe was doubtful and weak but that today it is operating on a defense plan which is sound as to tactical organization and doctrine.

Lt. Gen. Manton S. Eddy





Atlanta joint meeting with local unit of Military Order of World Wars. L to R: Hugh L. Quarles, MOWW commander; Lt. Gen. Alvan C. Gillem, USA (ret.), director, AFCA Atlanta Chapter; Kelly Mosley, president, Atlanta Chapter.

General Eddy's address was enthusiastically received by the 200 members and guests present. Kelly Mosley, president of the Atlanta AFCA Chapter, and Hugh L. Quarles, commander of the MOWW unit, acted as co-chairmen of the meeting, which was held at the Brookhaven Country Club in Atlanta. A social hour and dinner preceded the evening's program.

Augusta-Camp Gordon

Speaking before the September meeting of the Augusta-Camp Gordon Chapter, Mr. J. S. Bonner, General Coordinator of Civil Defense Services of the Southern Bell Telephone and Telegraph Co., told the group that "we kid ourselves into believing that nothing can happen to us."

Long range bombing makes any area in the United States vulnerable to attack, Mr. Bonner pointed out. With radar weakest at detecting low flying objects 5,000 feet or less from the ground, Mr. Bonner stressed the necessity of having trained ground observers in round-the-clock operation to spot aircraft.

"There are two or three thousand of these ground observers posts scattered across the nation," the speaker said, "and they are run entirely by non-paid civilian volunteers." These posts, he went on, report to a filter center every plane sighted, and its path is marked on a map. The information then goes to a military operated Air Defense Direction Center where air interceptors are ready to be alerted at the slightest suspicion. The same information is also passed on to the one of nine Air Defense Control Centers in the United States. These control centers have flight plans of every plane in the air above the United States.

Mr. Bonner also described and operated a laboratory model of an air raid warning communications system developed by the Bell Telephone Company.

Among the members and guests present were the following civil defense officials responsible for civil defense planning on city, county and state levels: Sam McCuen, director of communications, Aiken County; F. A. Saxon, director of communications and civil defense, Augusta-Richmond County; John W. Weems, chairman, civil defense council, Aiken; E. W. Fruit, civil defense communications, Southern Bell Telephone, Columbia, S. C.; W. R. Carter, Southern Bell Telephone state civil

defense coordinator, Columbia, S. C.; Lt. Col. A. W. Haynes, Camp Gordon; Mrs. Freiberg, civil defense director, Augusta; Sydney Carter, executive director, city-county planning and zoning commission.

During a brief business meeting, the following interim appointments were approved by the members: Lt. Col. Bertie L. Avera, personnel and administration director of The Southeastern Signal School, was appointed vice-president to succeed Major Joseph P. Sahm who had been transferred overseas. Named as directors were: F. A. Saxon, division engineer, Georgia Power Company; Col. T. J. Tully, commanding officer of the Signal Corps Training Center; and Col. Edward L. Orstad, executive officer of the Signal Corps Unit Training Group. Col. Harold A. Buck, commanding officer of the Signal Corps Replacement Training Center, was appointed committeeman to replace Col. Louis J. Tatom who retired from the Army and moved out of the chapter area.

The chapter's August meeting was addressed by Evans Flemming of the Georgia Power Company who demonstrated a radar type line fault locator. This unit transmits a five micro-second pulse along a line. The pulse is reflected back to the source by a fault. Both the out going pulse and the reflection are indicated on the oscilloscope. By synchronizing the outgoing pulse with the reflection, which is accomplished by varying the frequency of the calibrated pulse generator, an accurate determination of the pulse travel time can be made. By applying this travel time to the known velocity in each type of line construction, the wire distance to a fault can be easily determined.



Shown at Augusta-Camp Gordon's meeting on civil defense (l to r): F. A. Saxon, director; Lt. Col. Fred J. Elser, president; W. O. McDowell, director; Col. Dawson, guest; J. S. Bonner, main speaker; Col. T. J. Tully, director; Mrs. G. W. Freiberg, guest; Lt. Col. A. W. Haynes, guest; Col. H. A. Buck, committeeman; Lt. Col. B. L. Avera, vice president.

Baltimore

A first hand view of the latest Coast Guard Patrol Boat, the 95′ WPB, together with its associated marine and electronic equipment, was given chapter members and guests at the U. S. Coast Guard Curtis Bay Yard on September 29th.

Following dinner in the mess hall, the 98 members and guests were welcomed to the Coast Guard Yard by Capt. E. E. Comstock, administrative officer, who highlighted the responsibilities and functions of the Coast Guard and the relative importance of its communications system.

An inspection trip aboard the 95′ WPB was conducted by Capt. Comstock; Cdr. M. W. Caskey, shop superintendent; Lt. Cdr. J. D. Luse, electronics officer; L. P. McGoldrick, electronics shop master; and D. H. King, electronics estimator.

Equipment inspected in the pilot house consisted of the remote control transmitter, public address system, radar system and the gyro repeater. The radio and chart room inspection covered the following: ship-to-shore phone system, radio direction finder, communication facilities, loran receiver indicator, VHF communications, fathometer, and gyro compass.

Following the inspection, the group adjourned to the recreation hall to hear a discussion on practical field testing of electronic equipment by Cdr. J. B. Oren, USGG, and an illustrated talk on metal corrosion and its mitigation by George E. Best, manager of technical service, Mutual Chemical Company of America.

The evening's program concluded with a tour of the yard's electronic shop where the members and guests witnessed a radar operation, loran transmitter and timer in operation, inspected the small equipment repair facilities, and visited the gyro compass laboratory.

Earlier in the evening, a small clock radio donated by Westinghouse Electric Corp. was raffled off with the proceeds going to the chapter treasury.

Members of the chapter's recently organized board of directors are: L. D. Kiley, general manager, Bendix-Friez Div. of Bendix Aviation Corp.; F. W. Godsey, general manager, Baltimore Div. of Westinghouse Electric Corp.; William G. Morrell, vice-president and general manager, Chesapeake and Potomac Telephone Co. of Baltimore; Capt. E. E. Comstock, administrative officer, U. S. Coast Guard Curtis Bay Yard; John Pearce, president, Phebco Corporation; Joel Jacobson, vice-president and general manager, Aircraft Armaments Corp.; John W. Downing, president, Downing Crystal Company; Col. James D. Dreyfus, signal officer, Second Army, Fort Meade; Col. A. H. Anderson, commanding officer, Baltimore Signal Depot; Ewell K. Jett, vice-president, WMAR-TV.

Boston Chapter's reception for Armed Forces commanding officers. L to R: Rear Adm. Charles B. Momsen, USN; Rear Adm. Joseph R. Redman, National AFCA President; Raymond B. Meader, Chapter President; Maj. Gen. Roderick R. Allen, USA; Maj. Gen. Raymond C. Maude, USAF.



Boston

A reception for the Armed Forces commanding officers in the Boston area, with Rear Admiral Joseph R. Redman, USN(ret.), AFCA National President, as a special guest, featured the chapter's opening fall meeting.

The Armed Forces commanders honored were: Maj. Gen. Roderick R. Allen, Commanding General, Bos-

ton Army Base and Fort Devens; Rear Adm. Charles B. Momsen, Commandant, First Naval District; and Maj. Gen. Raymond C. Maude, Commander, Air Force Cambridge Research Center. Rear Adm. Raymond J. Mauerman, Commandant First Coast Guard District, was also invited but was unable to attend at the last minute.

Meeting at the Officers' Club of the U. S. Naval Receiving Station in South Boston, the members and guests were welcomed by Admiral Momsen as guests of the Navy. In his remarks, Admiral Momsen commented that the AFCA can do a fine service as liaison between the armed forces and industry.

Admiral Redman reviewed the aims and objectives of the association and the progress being made in carrying them out, and particularly emphasized the fact that the association must broaden its base to include all the electronics industry instead of merely its communications aspects.

General Allen pointed out that organizations such as the AFCA can perform a public service by doing all possible to enhance the prestige and dignity of military service so as to attract young men to the service as a career. Only in this way, he said, can the services economically utilize men whose period of training has been increasingly prolonged due to increased complexity of military equipment particularly electronic equipment.

General Maude, a former national vice-president of the association, stated that from his personal experience it was clear that the AFCA is becoming more and more known and recognized throughout the services and the electronics industry, and that its mission is becoming increasingly better understood.

A social hour and dinner preceded the evening's program. Chapter President Raymond B. Meader outlined plans for the chapter's activities and accomplishments during the coming year. Membership Chairman Dan Greene reported on the activities of his committee which had already increased the membership roll to an all-time high.

Among the guests present was Capt. J. A. Callaghan, Chief of Staff, First Naval District.



The Allied Radio Corporation was host to the Chicago Chapter for its opening fall meeting on September 24th. Shown above is a portion of the attendance at the dinner meeting, which was followed by a tour of the company's new plant.

Chicago

The first meeting of the 1953-54 season was held at the offices and plant of the Allied Radio Corporation, AFCA group member, on September 24th, with more than 200 members and guests in attendance.

After cocktails and dinner, Mr. A. D. Davis, President of Allied Radio, welcome the group and then spoke of the essential function of the distributor in the modern economy, with special emphasis on the need for effective distribution in an industry as complicated as that of electronics. Commenting on the service performed by Allied to the Armed Forces and industry, in maintaining inventories of 20,000 separate stock items obtained over 500 suppliers, Mr. Davis said:

"Keep in mind all the paper work involved, including sales, credit, production control, transportation and accounting that must be done for every small order just as completely as for a carload lot. When the cost of processing the direct small order is added to the manufacturing cost, the actual unit cost usually becomes prohibitive. Even without the added costs to the customer because of delayed delivery time, it is obvious that the time and place utility of our distribution adds value to the manufacturer's item at an economical price, for the size and type of orders we are prepared to handle."

Following the talk, the members and guests toured the plant into which Allied had moved recently and which covers a full city block near the geographical center of Chicago. Guides explained how the system of pneumatic tubes, automatic dial phones and conveyor belts speed handling of orders. Many of the members were especially interested in the system of inventory control, with "forward" stocks, considered already sold, constantly being replenished from a 60-90 day supply of "reserve" stock. The ultra-modern plant building itself was also of much interest to the visiting group since it incorporates the latest techinques, such as a most effective use of color, air-conditioning, soundproofing, and recessed lighting of offices and salesrooms.

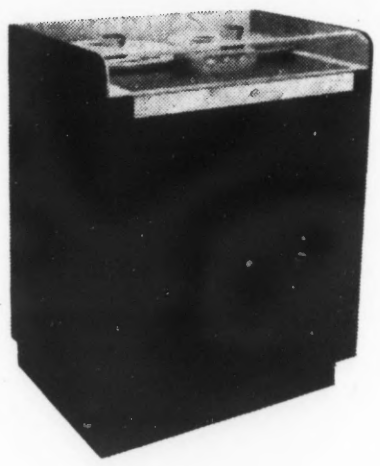
Dayton-Wright

Colonel H. A. Boushey, Wright Air Development Center, was guest speaker at the chapter's August 25th meeting and discussed the new policy of weapons system concept now in use by the Air Force.

Chapter officers for 1953-54 are: president—George B. Meyer, Westinghouse Electric Corp.; vice-presi-



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Fort Monmouth

Some 200 members and guests turned out for the opening meeting of the fall season which featured an illustrated lecture on "Patent Oddities" by Edward K. Kaprelian, former chief of the photographic branch of the Signal Corps Engineering Laboratories. Mr. Kaprelain, who is now director of research for the Kalart Company of Plainville, Conn., is a recognized authority in the field of patents. He served as patent adviser for the Office of the Chief Signal Officer in 1945-46, and prior to that was a patent examiner in the U. S. Patent Office. He is also credited with a number of patents in the photographic field.

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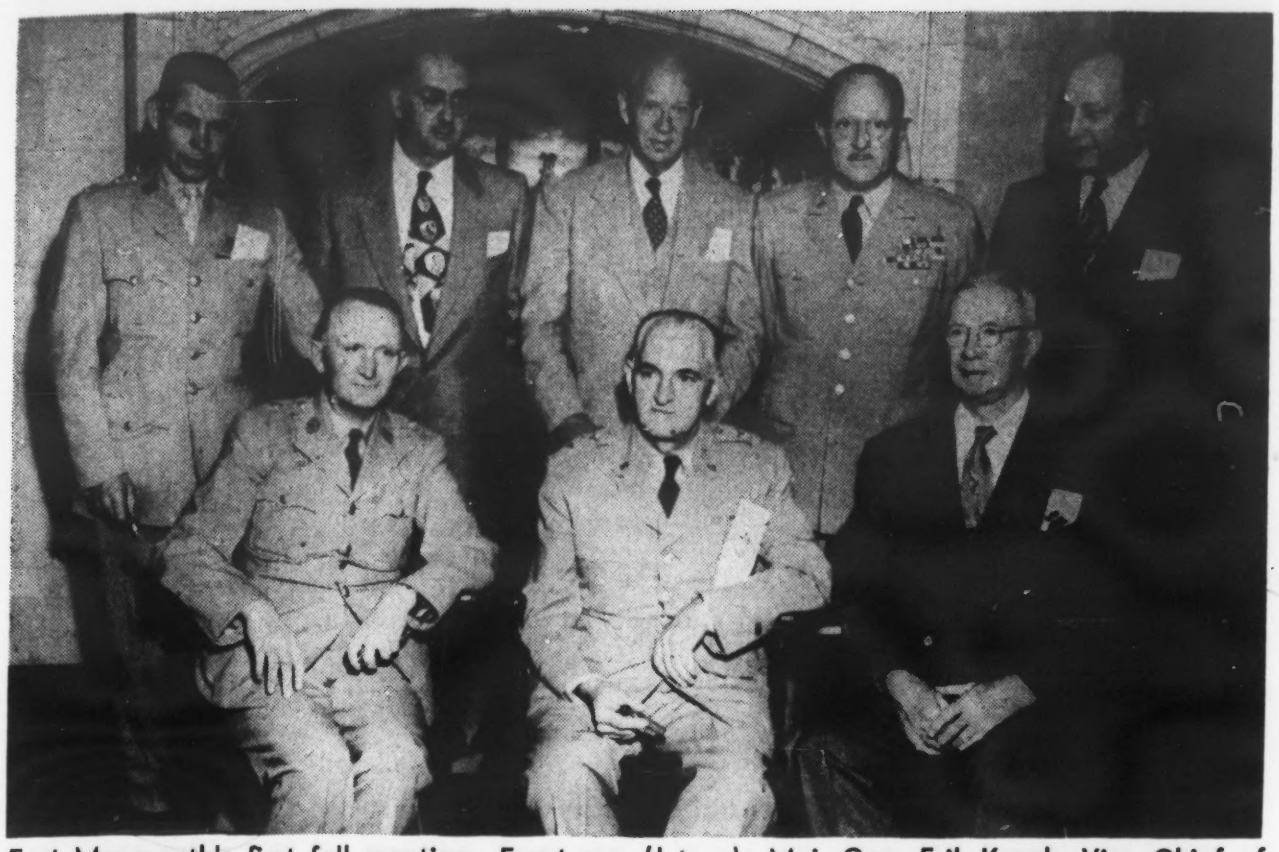
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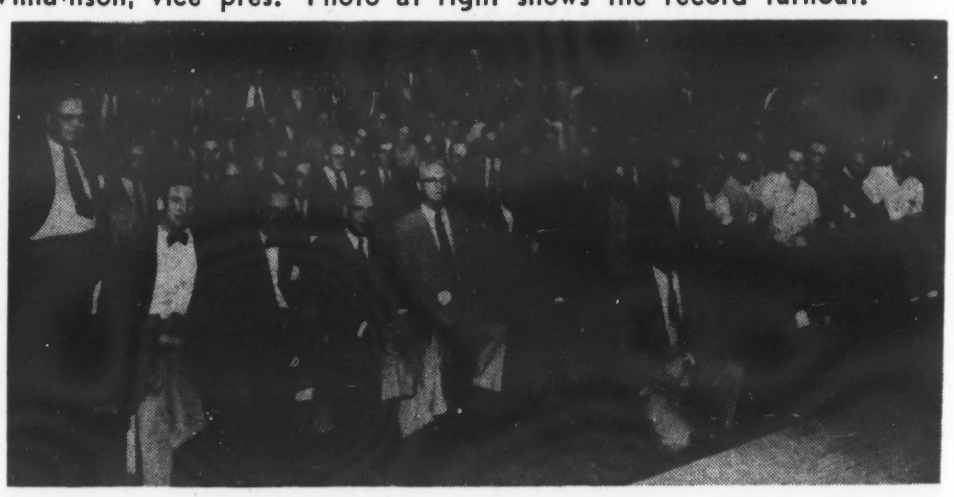
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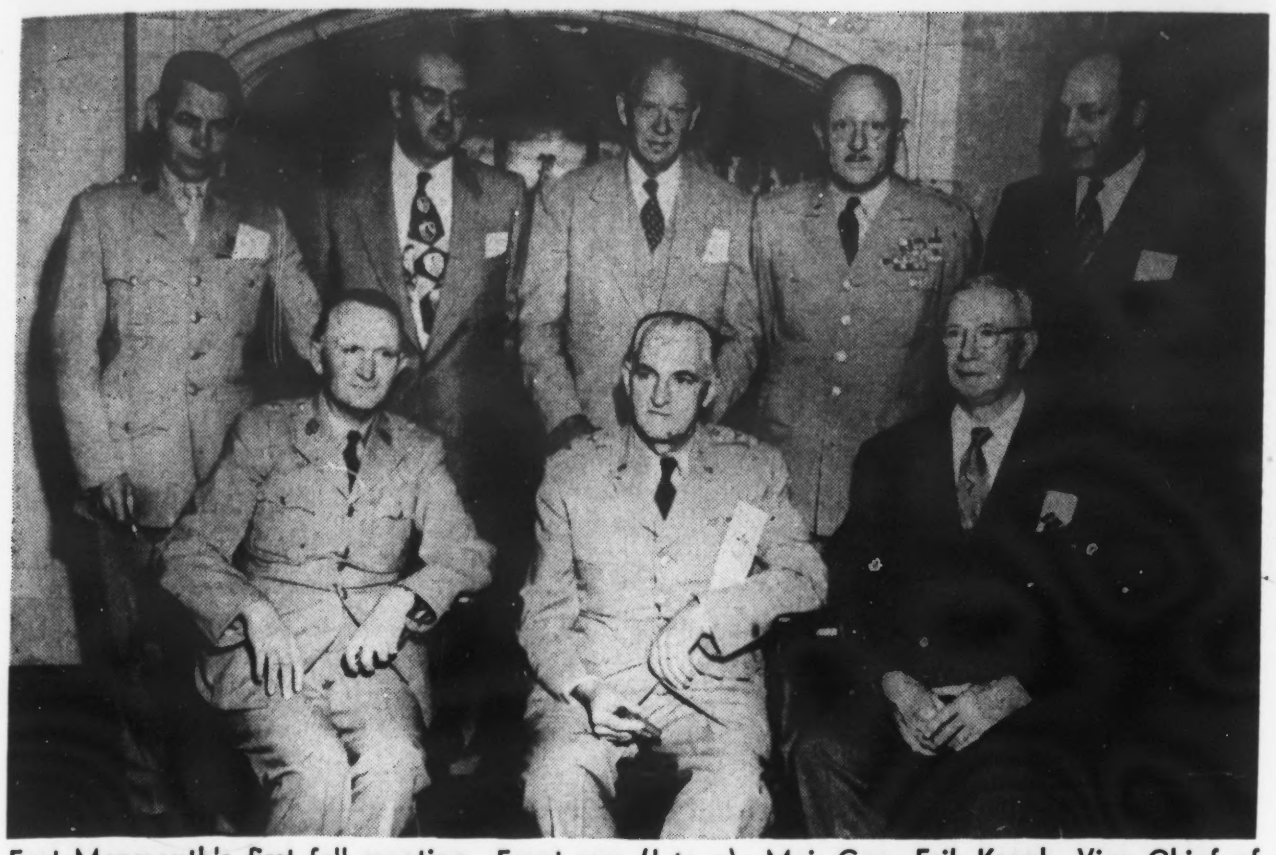
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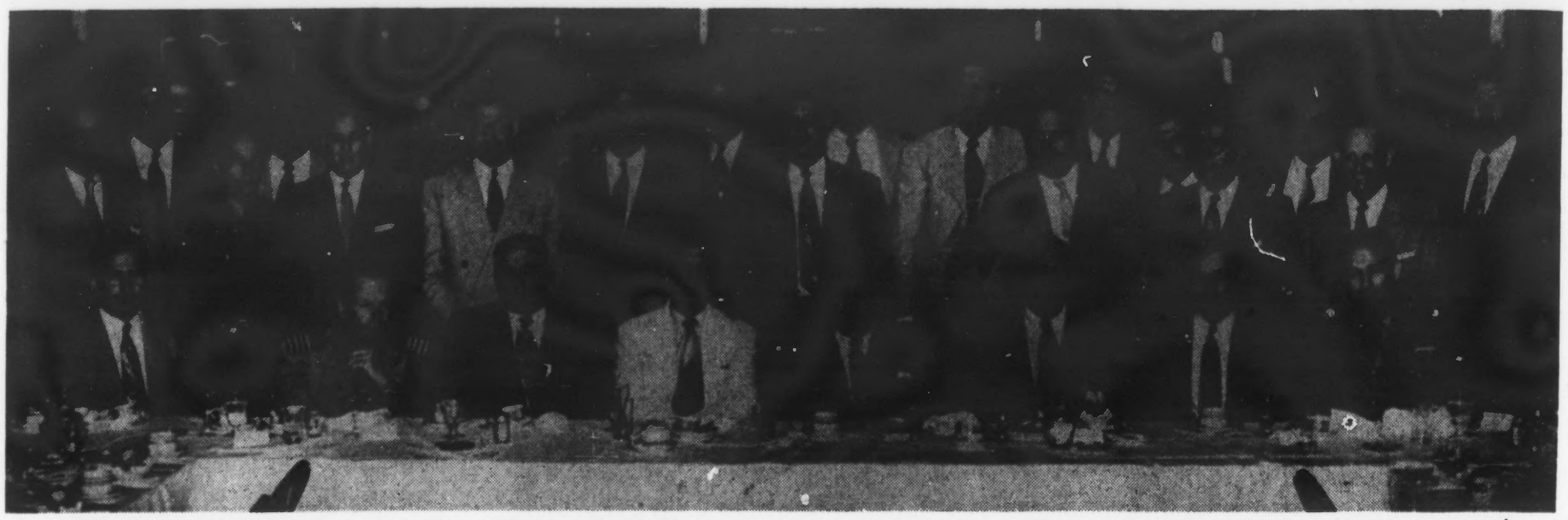
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USMC (ret.); members executive committee — R. E. Cramer, Radio Condenser Co. and J. D. McLean Philco Corporation.

Committee chairmen are: civilian defense: Philadelphia — W. J. Cannon, Bell Telephone Company; Camden—T. A. Smith, RCA Victor Div.; membership—Edward Barth, Philco Corp.; program—George M. Cohen, SigC Supply Agency; publicity—Norma L. Testardi, International Resistance Co.

Pittsburgh

The Pittsburgh Chapter turned out in full force to attend a Fish Fry at Totem Pole Lodge, South Park on September 17. Two hundred and ten members and guests joined in an evening of fellowship and entertainment that brought at least fourteen new members into the fold.

The entire program under the chairmanship of Bill Lockhart of Bell Telephone Company was enthusiastically received. The party got under way at 5 o'clock with registration, distribution of favors and a get-acquainted period where horseshoes, volleyball, softball and a few barrels of beer broke down any barriers to pleasant conversation and fellowship. A fine dinner was served by a caterer and a vast quantity of fried fish, deviled crabs, hot dogs and trimmings was consumed.

The entertainment, which consisted of music, feature acts, and movies, got off to a fine start with an exhibition of sleight-of-hand by Nardine and Naydine, and was followed by distribution of about twenty-five door prizes contributed by interested companies.

The honor guests of the chapter were introduced by President Sam Phillips as follows: Brig. Gen. Theodore L. Futch, Chief, Pennsylvania Military District; Col. Frank M. Maerdian, chief, Ohio Military District; Col. Raymond W. Rumph, commanding officer, 18th AAA; Col. Robert C. Lutz, Pittsburgh representative, Chief Pennsylvania Military District; Maj. J. G. Schweigert, detachment commander, Pittsburgh Filter Center.

All in all, the evening was an outstanding success, credit for which goes to the chapter's hard working program committee.

San Francisco

Stanford Research Institute, newest group member of the San Francisco Chapter, was host at the meeting held in Menlo Park on September 17th. Dinner preceding the technical program was at Ramor Oaks Restaurant in nearby Atherton, with over sixty members and guests present.

Col. Lloyd C. Parsons, chapter president, reviewed the purposes of the AFCA and its mission of building close cooperation between military and civilian communications-electronics - photographic personnel. The activities and growth of the chapter during the past several years were outlined, and of particular interest to the membership was the announcement that the chapter had already achieved its 1953 goal of 200

Stanford Research Institute was host to the San Francisco Chapter on September 17th. A most interesting tour of the facilities of the Institute was followed by a number of technical talks by staff members.



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members. The affiliation of Stanford Research Institute was announced and its representatives were introduced together with other new members and guests present.

Mr. Beardsley Graham, Assistant Director of Stanford Research Institute, outlined the program for the remainder of the meeting and the group adjourned to the laboratories and offices of the Institute in Menlo Park.

Inspection of the facilities of the Institute proved to be one of the highlights of the year's activities. The tour was arranged to give maximum emphasis to communication and electronic subjects, although the Institute's research activities apply to a wide range of fields. Of particular interest was the work being done in color television, flush aircraft antennas, single sideband transmission, and auto-fabrication and assembly of electronic equipment.

Following the tour, Mr. Graham discussed the history and operation of the Institute and explained the Research Team concept which brings together experts from many diverse fields to do cooperative work on a research problem. A team may include a physicist, mathematician, economist, chemist, electrical engineer, and others according to the nature of the project.

Staff members of the Institute were introduced and discussed their special fields of interest. Dr. Vincent Salmon described some of the work remaining to be done in sonics; Mr. Edwin Gamson and Dr. John Bolljahn outlined auto assembly techniques for electronic equipment and recent aircraft antenna developments. Mr. John Honey discussed the current status of single sideband radio systems, and Mr. William Evans explained some approaches to the color TV problem.

An open discussion session following the talks brought the very successful evening to a close.

Scott-St. Louis

The September 11th meeting was addressed by Leslie Norde, chief receivers engineer, Hammarlund Manufacturing Company, AFCA group member. His subject was the design of a radio communications receiver, its related problems and solutions. A Hammarlund SP-600-JX receiver was used as a demonstrator.

An interesting question and answer period followed the talk. Mr. Norde



Scott-St. Louis October meeting was addressed by Art Kowitz, head of Motorola training program. Above, left to right: Capt. Eugene McElroy, author of "VHF Communications in Korea" which appeared in Sept.-Oct. SIGNAL; Art Kowitz; and Jack Barnes, Motorola communications engineer.

was accompanied by H. S. Van Wambeck, chief engineer of Hammarlund.

"The Motorola Microwave Story" was presented at the chapter's October 9th meeting by Art Kowitz, head of the Motorola training program. With the aid of color slides, Mr. Kowitz gave a vivid description of a typical microwave communications setup. He discussed problems concerning antenna feeding and positioning and some intriguing systems involving "passive" reflectors atop the mountains to permit microwave linkage in difficult geographic areas. He concluded his talk with a question and answer period. Assisting Mr. Kowitz at the slide projector was Prosper Kinsella, a member of the chapter.

During the business meeting which followed dinner at the Elks Club in Belleville, Chapter President Allan Eisenmayer announced that Clifford Wassall, defense activities engineer of the Southwestern Bell Telephone and Telegraph Co., was ahead in the chapter's membership drive contest. In second place was Allan Bagnewski, who has also been a two-time winner in the drawing for a free meal given in connection with the membership drive. 2nd Lt. James F. Fields, a student in the communications officer course at Scott Air Force Base, and a charter member of the chapter, was welcomed back after a two-year absence for duty away from the area.

Another feature of the business meeting was the drawing for door prizes donated by various members, which included two cathode ray tubes, a milliameter and a box of transmitter parts. Winners were Ed Schlict, Ben Otten, Allan Bagniewski and Howard Yund. Plans were discussed for the December meeting, which will mark the third anniversary of the chapter, and it was decided to make it a "bring the wives and girl friends" occasion.

The chapter was privileged to have as a guest Capt. Eugene J. McElroy, USAF, who authored the article "VHF Systems in Korea" which appeared in the September-October issue of SIGNAL.

South Carolina

At a recent meeting of the board of directors of the South Carolina Chapter the following officers were elected to fill vacancies created by transfers out of the area: president—Walter G. Edwards, district manager of Southern Bell Telephone and Telegraph Company, Columbia; directors—Rufus C. Barkley, president, The Cameron and Barkley Company; Lt. Col. Oscar T. Tigner, Southern Bell T&T Co.

Southern Connecticut

Application for charter for a Southern Connecticut Chapter was received and approved at national headquarters in October. The chapter was organized through the efforts of Lincoln Thompson, vice president of SoundScriber Corporation, and Col. Edgar L. Love, sales manager, Koiled Kords, Inc., with the able assistance of Dan Greene, AFCA regional representative.

Interim chapter officers have been elected as follows: president—Col. Edgar L. Love; 1st vice-president—Lincoln Thompson; 2nd vice-president—H. J. Hoffman, Machlett Laboratories, Inc.; secretary—James J. McKeon, SoundScriber Corporation; treasurer — E. P. Hurley, Southern New England Telephone and Telegraph Company.

Chapter headquarters are in New

CHAPTER NEWS

Haven, Conn., where a membership drive is now in progress. AFCA Executive Vice President George P. Dixon will formally present the chapter charter at the opening meeting of the Southern Connecticut Chapter on November 17th.

Washington

A better understanding of the vital role that AFCA's three fields of interest — communications, electronics and photography — play in the mission of the Army Medical Service was given Washington Chapter members at their opening meeting on October 7th by Major General George E. Armstrong, The Surgeon General of the Army.

To show just how much the Army Medical Service relies on communications and electronics, General Armstrong took the audience on a verbal tour through the entire chain of medical evacuation from the battalion aid station near the front line to the large, completely equipped medical centers in the United States — a tour which vividly described how communications helped return the wounded soldier to this country and how electronics assisted in his recovery.



Maj. Gen. George E. Armstrong, Surgeon General of the Army.

Going on to the field of research, the speaker pointed out that Army Medical Service researchers, working on thousands of projects in many specialized fields of medicine, are daily making use of numerous pieces of electronic equipment, and that the results of such research, which would be impossible without the aids of electronics, have increased medical knowledge and accordingly made possible better care of soldier-patients.

Without the aid of modern communications and electronics, General Armstrong concluded, many servicemen would have lost their lives on the Korean battlefields or would have been hopelessly crippled.

The luncheon meeting was held in the National Press Club, with Chapter President Thomas B. Jacocks presiding. Others at the head table were: Rear Admiral Joseph R. Redman, National AFCA President; Maj. Gen. George I. Back, Chief Signal Officer; Rear Admiral Joel T. Boone, Chief Medical Director, Veterans Administration; Brig. Gen. Rawley Chambers, Chief of Professional Services of the Army Medical Corps; Dr. John B. Alsever, Director, Blood Program Div., Health and Special Weapons Defense Office, FCDA; Capt. O. D. Yarbrough, USN, Director, Research Div., Bureau of Medicine and Surgery; Col. Sheldon Brownton, Exec. Asst. to Asst. to the Secretary of Defense, Dept. of Medicine.

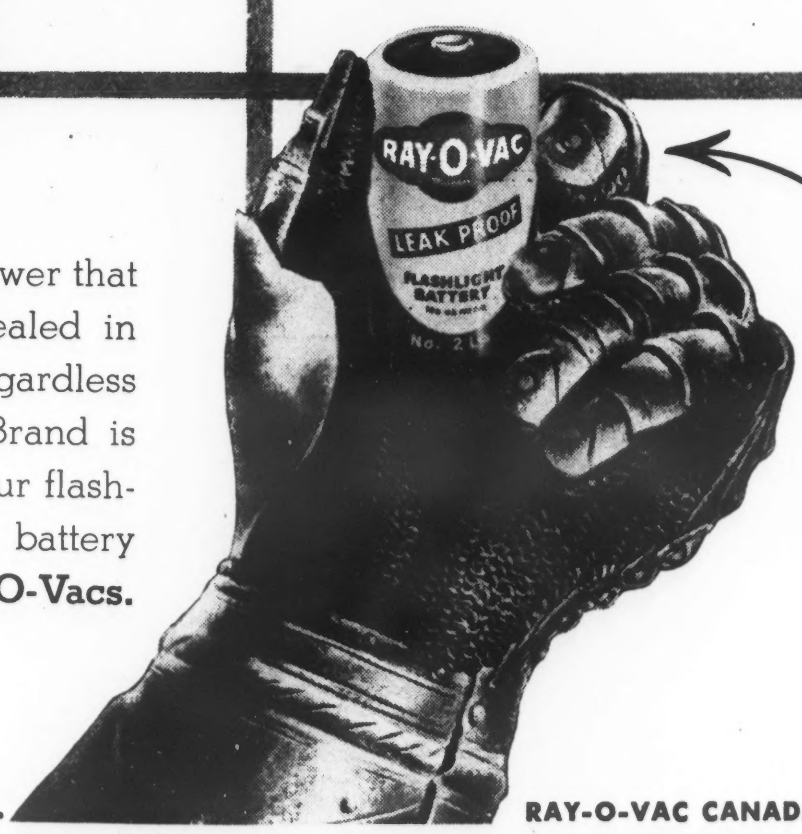
Among the 250 members and guests present were a group of senior Signal Officers at U. S. installations who were in Washington for a week's conference with the Chief Signal Officer and his staff.



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NEWS

Communications-Electronics-Photography

Adaptable Electronic Chassis

In response to the need for a components chassis that would lend itself to varied and changing electronic designs, I. Rotkin and J. Guarracini of the National Bureau of Standards have developed a widely adaptable chassis that is both economical and convenient. The design of the new chassis includes a rectangular frame made of $\frac{3}{8}$" x $\frac{1}{16}$" steel angle and sets of flat plates that are fitted to the frame with screws. The frames vary in size so that chassis may be made up as small 3" x 4" boxes, or 3" x 13" x 16" models, or even whole networks of different-sized chassis.

Conventional electronic chassis, normally built with five sides, often impose restrictions on the movement of tools used to drill and punch the required holes and recesses. After the components have been installed in the chassis and the experimental circuit tested, either a relatively expensive equipment must be thrown away or valuable storage space must be used for an item that is only potentially useful. Even during the development stages of the circuit, the design of conventional chassis does not lend itself to exposure of the circuit wiring and tube sockets to facilitate probing and rewiring. Sometimes a great simplification is possible in the construction of equipment if several "breadboard" models can be pieced together, but this is a difficult task requiring complex mechanical structures if the components are mounted in standard chassis.

The chassis developed by NBS are produced in four standard sizes, all 3" high: 16" x 13", 13" x 8", 8" x 4", and 4" x 4". Flat cover plates are drilled with holes that match screw-holes in the frames. The dimensions of the chassis and plates were chosen so that the long side of each chassis matches the short side of the next larger size. When desired, any of the six side plates may be left blank or discarded entirely; thus, ventilation may be obtained for circuits requirment and sampling cycles. This unique feature is made possible by the use of electronic shift registers to transfer data from the input counting channels to the recording section without interrupting the measurement process.

An important element in the data reduction process is the new Potter Digital Magnetic-Tape Handler which is used as the basic recording medium. High-speed and precise control of tape starts and stops permit recording of data from all four channels at high rates and playback at the slower speeds required to accumulate the information on tabulating cards, or for insertion into electronic computers.

Important business and industrial applications are predicted for the new equipment since the techniques established in the development of the reversing decades, shift registers, card punch translators, and other units have a variety of applications in these fields. Individual components or complete systems are now available to provide sampling rates to one hundred per second, and these may be combined with existing or proposed methods employing punched cards, direct data printers, or magnetic tape recorders.

Repair Work in Germany

LEIPHEIM, GERMANY — The 28th Division's mobile signal maintenance team, as part of their regular routine, visited the 628th Tank Battalion recently to repair the unit's radios. When the crew's job was completed, the tankers had all but 2% of their radios in operation.

That's the kind of proficiency that these signal gypsies are exhibiting throughout the 28th Division in their efforts to give Keystone units top quality in one of their most vital needs, communication. Upon arrival at a unit all inoperative radios are turned over to the five-man crew. The men check them, replace parts, make repairs and turn the radios into operating condition whenever possible.

The value of communications is well known to the front-line soldier whose life depends upon constant contact with higher echelons. In Germany where units spend most of their time training in the field, a great reliance is placed on radio communication and these signal crews perform a vital service which gains the gratitude of every unit they visit.

Cpl. Bernard Baker, chief of one of the 28th Division's radio repair teams, completes a circuit as Pvt. Jerald Stevens checks the connection. Assisting with controls in the background is Pfc. Jerry Robson.



New Two-Phone Intercom System Announced by RCA

A new low-cost telephone-type inter-communications system called the "Duo-Com" and designed for use in homes, professional offices, farms, schools, business and industry was announced recently by the Engineering Products Department, RCA Victor Division, Radio Corporation of America.

The simplified two-phone system provides instant natural voice communication and will operate more than a year on a single six-volt battery. Contact between the phones is made simply by lifting the receiver

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Ability to think big about miniaturization problems is only one of the many talents that has set Raytheon apart in the field of electronics. It is an example of how Raytheon is serving the current needs of the Armed Services while paving the way for new and better developments.

Not all Raytheon products are small but all benefit from Raytheon's broad experience with miniaturization. Raytheon pioneered in the development of reliable miniature vacuum tubes, now leads in the production of subminiature tubes, germanium diodes and transistors. Miniature magnetic components are another example of Raytheon's unique ability to pack perfection into incredibly small units.

Raytheon has also pioneered in the application of miniaturization techniques to complete equipments. The benefits are unmistakably reflected in the compact design, trim appearance and servicing ease of *all* Raytheon products which include radar, sonar, communications equipment and other types of electronic equipment used in all branches of the Armed Services.

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and depressing a button, eliminating dialing, switchboard, press-to-talk keys, and similar delays found in other intercom systems.

MAGNETIC RESEARCH SPONSORED BY AIR FORCE

The awarding of a contract to the Indiana Steel Products Co., Valparaiso, Ind., to conduct a comprehensive research program on magnetics to improve military air and ground devices utilizing magnets was announced recently by the U. S. Air Force's Air Research and Development Command.

The objective of the research will be to enable manufacturers to provide better electronic equipment for U. S. Air Force use, and to conserve weight, space and materials.

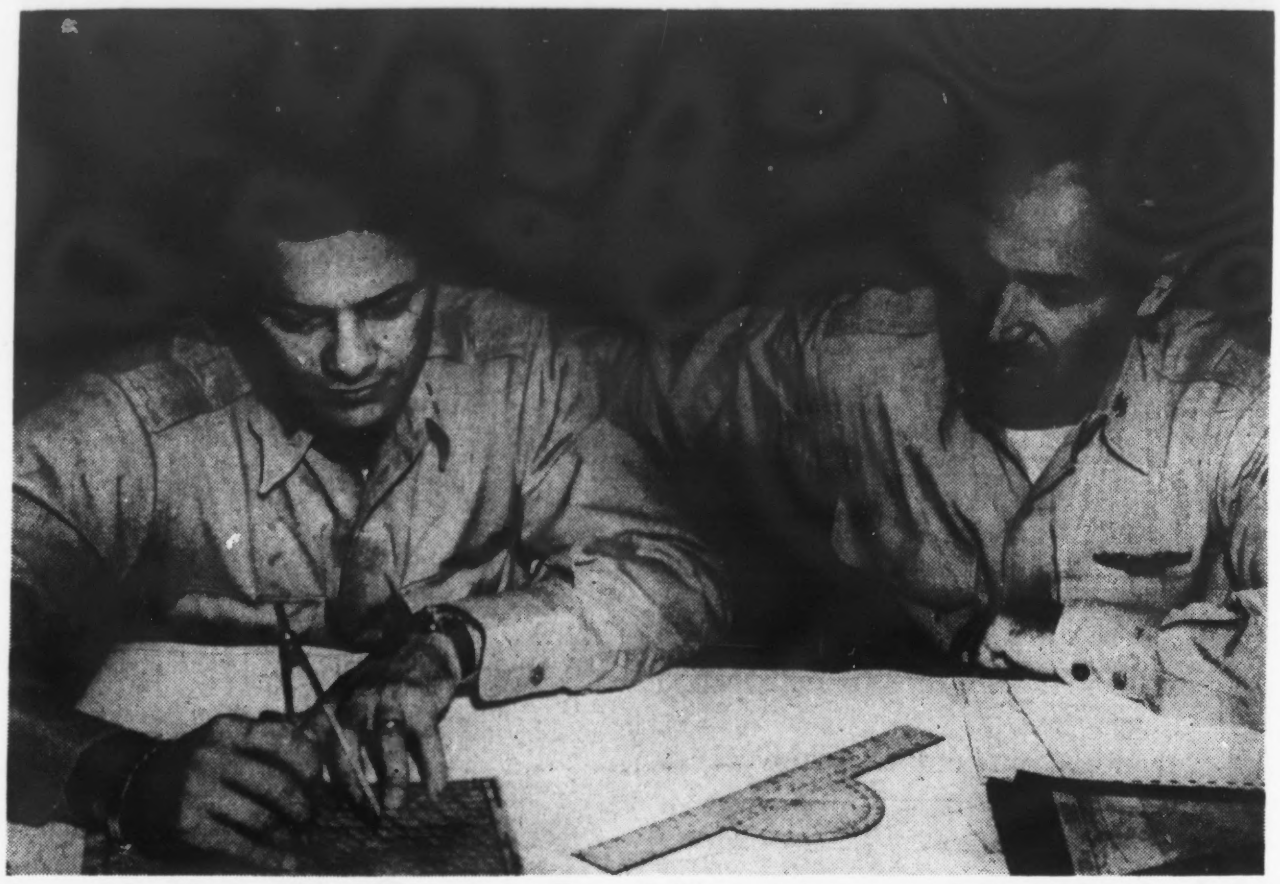
The program will include both basic and applied research and will cover the theory of magnetism, the source of magnetic energy, and factors affecting magnetic induction and coercive force, as well as design and application and a search for new magnetic alloys.

Raytheon "Mariners Pathfinder"

The peril of collision in fog or darkness — major hazard to small vessels threading their way through crowded harbors or along rocky coasts — has now been reduced through the magic of a new electronic device.



"Big Ship" radar, with its rotating antenna and all-seeing eye is no longer confined to Navy ships and other large, ocean-going vessels, it was revealed recently, but is available at moderate cost for use on tugs, workboats, yachts, motor launches, small fishing vessels, and similar craft.



Capt. John Harris, 35th ATS project officer (left), explains some of the intricasies of the experimental Loran overlay to Major Edwin Mann, squadron navigator.

The new radar has all of the essential features of its bigger predecessor, according to Raytheon engineers, who pointed out that their company now has more commercial marine radar sets in operation than those of all other manufacturers in the world combined. With this latest model, a captain can guide his vessel through a crowded harbor in thickest fog or darkest night, without fear of colliding with other vessels or objects.

Working on the standard radar principle, the Model 1500 sends out a radio signal like the rays of a searchlight. When these rays strike an object, they rebound like echoes, but with the speed of light. The radar picks up these "echoes" of its own signals, and translates the time interval between the signal and its echo into distance. The direction and distance of objects are indicated on a picture scope, similar to a television screen.

EXPERIMENTAL LORAN TESTED

KINDLEY AFB, BERMUDA — The navigators of the 35th Air Transport Squadron under Maj. Edwin Mann, squadron navigator, and base officers attached as navigators, were recently cited by the Aeronautical Chart and Information Center of St. Louis, Mo., for their part in the testing of experimental Loran overlay charts and books.

The Aeronautical Chart and Information Center said in their letter: "A preliminary study of the report regarding the above evaluation by your headquarters has been made. This center is impressed by the detailed presentation and technical effort which the evaluation reflects. The facts indicated will be thoroughly studied and your headquarters advised of the results and action taken. This center appreciates the complete cooperation demonstrated."

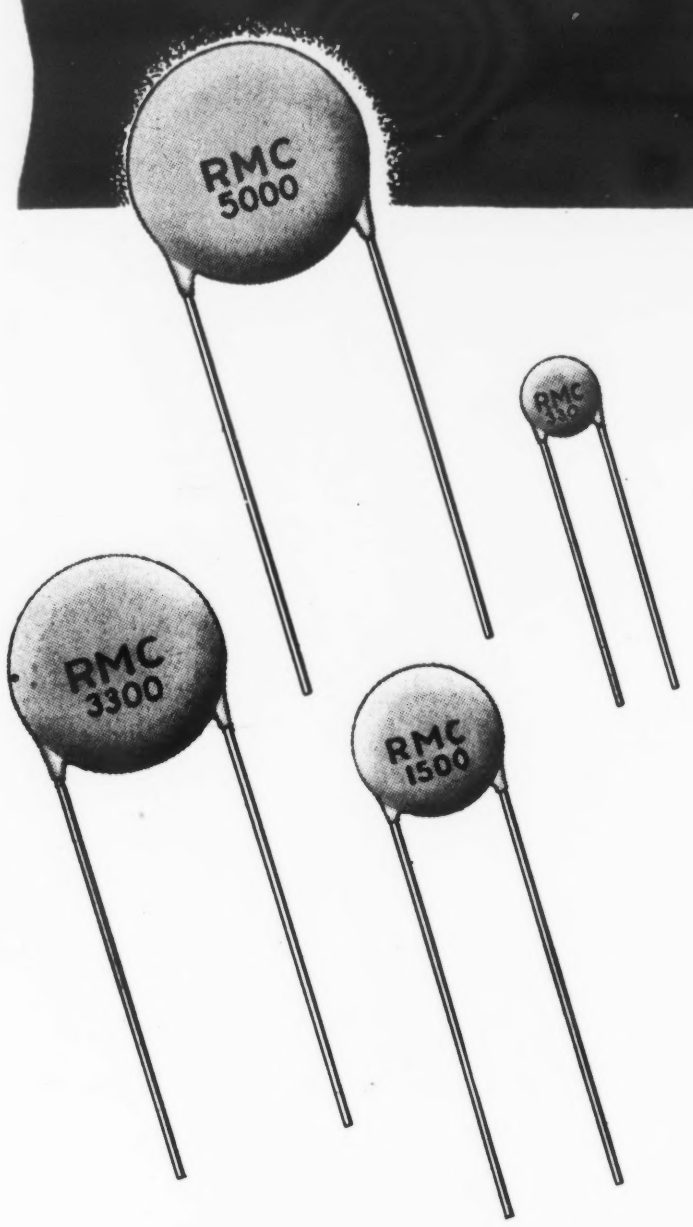
During the month of March 1953, the 35th Air Transport Squadron was assigned the work of testing the experimental charts and books between St. Johns, Newfoundland, and Lajes Field, Azores. The overlay charts consisted of four clear plexi-glass plates on which colored Loran lines were superimposed. The plates were numbered one through four and were positioned in sequence upon a normal mercator projection strip map. Loran fixes were plotted in pencil on the plexi-glass plate and transferred to the strip map by punching through the plate with the point of the dividers. The pencil marks on the overlays were readily erased, and the plate used over and over again.

While not in use the overlay plates were protected by storage in a loose leaf binder, which remained in the aircraft.

The entire procedure was designed to cut down navigator eye fatigue, since all forms of navigation such as dead reckoning, radio, and celestial could be plotted on one map without the strain caused by constantly viewing six to eight converging Loran lines.

Each navigator made at least two test flights and completed a detailed analysis of each flight. A consolidated analysis was forwarded through channels to the AC&I Center of St. Louis.

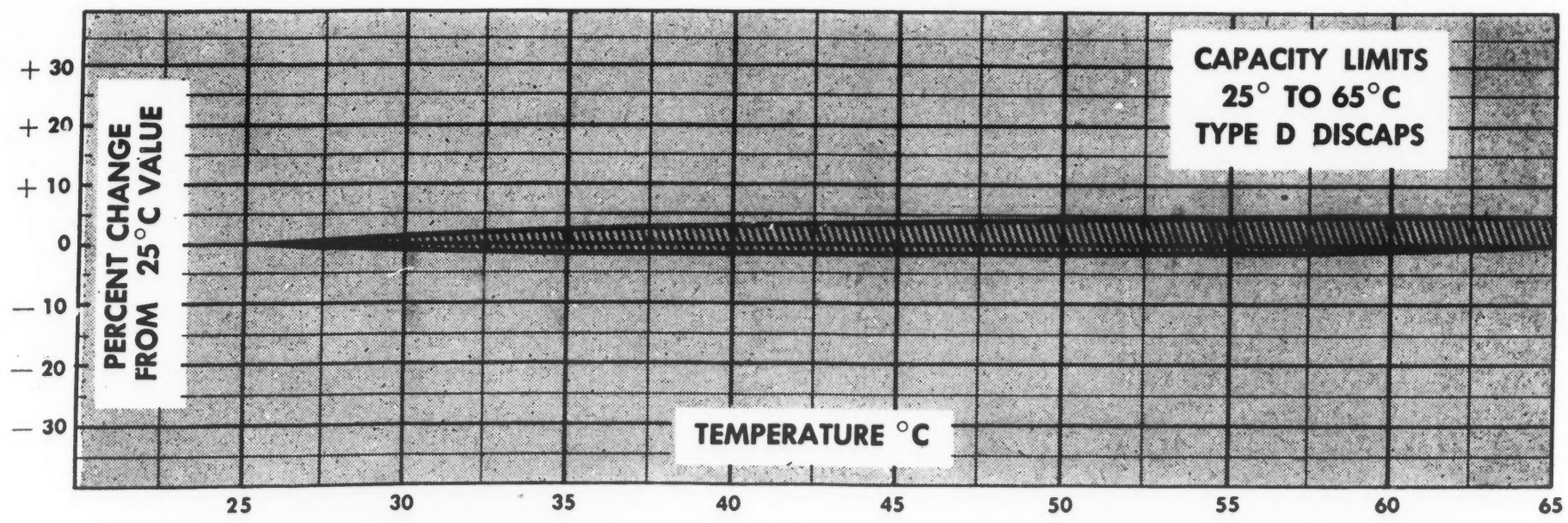
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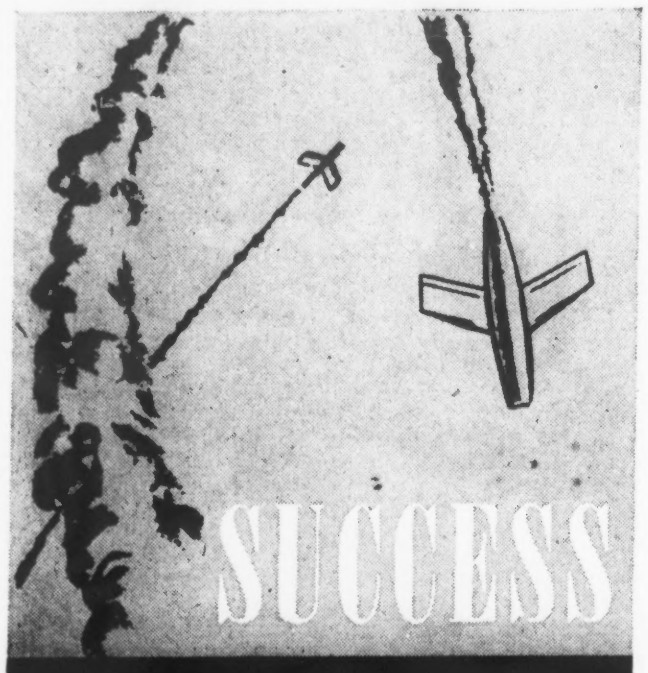
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NEWS

Annual Search for Scientists of the Future Launched

The annual quest for young men and women deemed the most promising for future careers in science was begun recently as high school seniors throughout the nation were invited to compete in the thirteenth annual Science Talent Search.

The long trail, upon which entrants from public, private and denominational schools will start soon, will lead 40 finalists to Washington next spring for the Science Talent Institute. During the five-day affair they will compete for a total of $11,000 in Westinghouse Science Scholarships and will hear addresses by some of the nation's leading men of science.

Dr. Leonard Carmichael, secretary of the Smithsonian Institution and principal speaker at the 1953 Science Talent Institute, in a statement recently commented on the Search as follows: "For a number of years I have had something to do with the listing and classification of our nation's scientists. The manpower problem is far more critical than that of filling our need for armed service personnel. The Science Talent Search is an invaluable aid in helping boys and girls to select and be educated for their chosen fields in the world of science."

The boy or girl whose all-around performance as well as personal characteristics are judged the most outstanding, will receive the top $2,800 scholarship. Other scholarships ranging from $100 to $2,000 will be awarded to the remaining 39 finalists during the Institute, which is slated to begin February 25.

New Digitizer and Magnetic Memory Speeds Data Handling

A multi-channel data handling system for use in aircraft and missile testing has been completed by the Potter Instrument Company, Inc., of Great Neck, N. Y., for Consolidated Vultee Corp. of San Diego.

The new unit is designed to digitize, sample, and record information obtained from Doepler-frequency effects or pulse code modulation from each of three independent channels and to provide, through a fourth channel, recorded time marker signals as a data reference. Special decades are used to allow addition or subtraction of counts and to provide an indication of algebraic sign of the total counts.

"On the fly" reading provides a marked increase in the data handling capacity of the system by eliminating the necessity of alternating measureing air circulation. No restrictions are placed on the kind of material from which the flat plates are made. Consequently, it is possible to eliminate much of the component insulation required when using all-metal chassis.

In developing a circuit, the components may be assembled in "breadboard" style on one or more flat plates before final mounting on a suitable frame. This procedure facilitates and simplifies the often laborious details of drilling, punching, deburring, or nibbling. Once the units have been mounted in the plates, they may be screwed onto the frames with all the wiring and tube sockets on the open (outer) side of the plate exposed to the probing of the test equipment. If the design and craftsmanship permit, these same plates may later be reversed; the wiring will then be protected, the tubes will be accessible for replacement, and the completed unit is ready for actual operation

If a component is a prototype or has become obsolete, only the plate containing the circuit in question need be removed from the frame and replaced with the improved circuit. The discarded plate can then be stripped of the easily removable components and stored in a shallow drawer or cabinet until a similarly patterned plate is needed again. If desired, whole clusters of these versatile chassis may be assembled around or on top of a larger chassis —the frames are sufficiently standardized to permit this. In addition, the spacing between the holes permits the mounting of commercially available bakelite terminal strips.

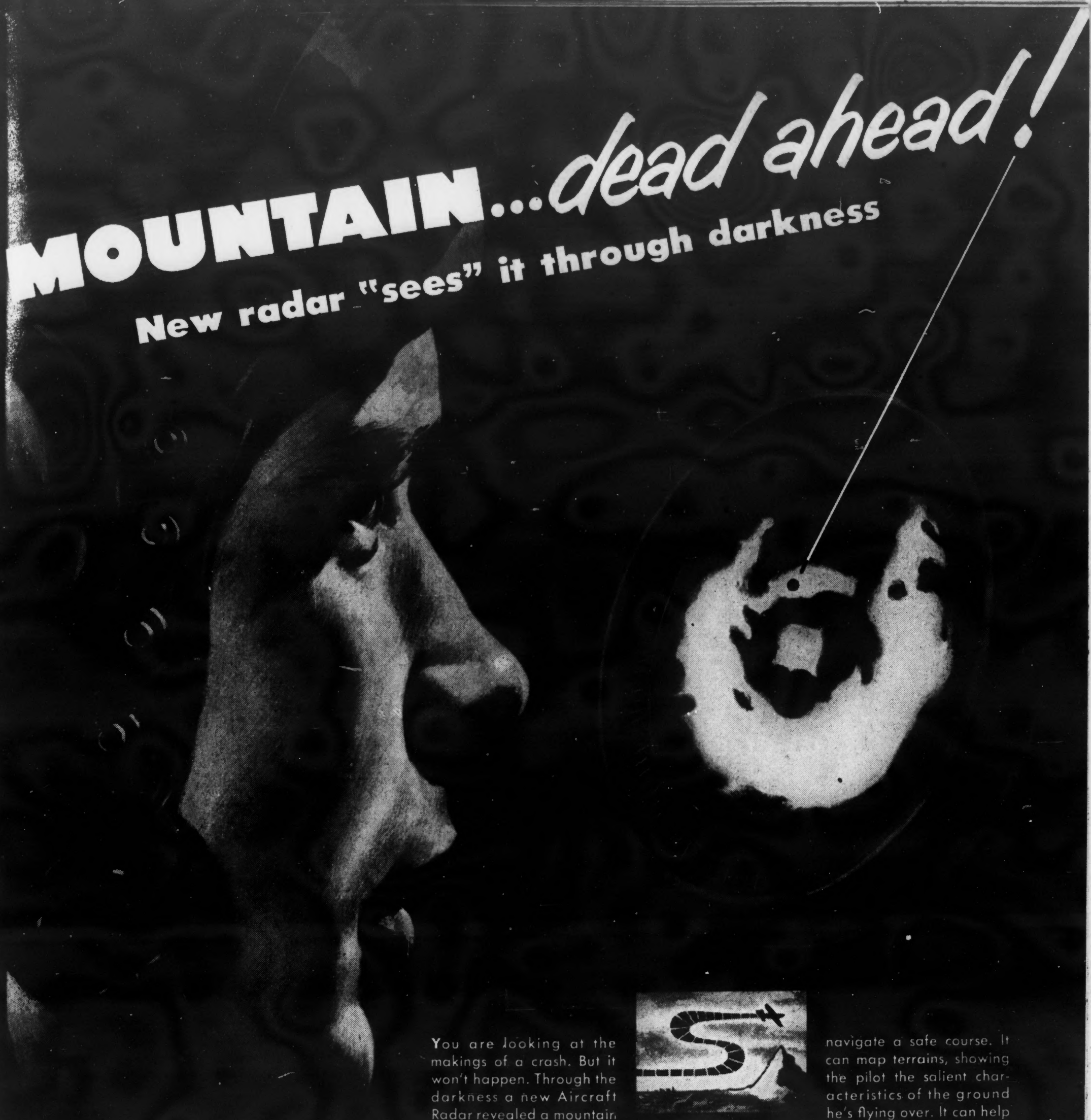
The Richards Company of Arlington, Virginia, now making the chassis under contract to the National Bureau of Standards, has contributed several design improvements that have been incorporated in the final model.

Times Facsimile Corporation Personnel Changes

Karl E. Clough, formerly District Manager of the Washington, D. C. office of Times Facsimile Corp., has been appointed Director of Sales, Stenafax Division, headquarters New York. He is succeeded in Washington by Rear Admiral John M. McIsaac, U.S.N. (Ret.).

MOUNTAIN...dead ahead!

New radar "sees" it through darkness



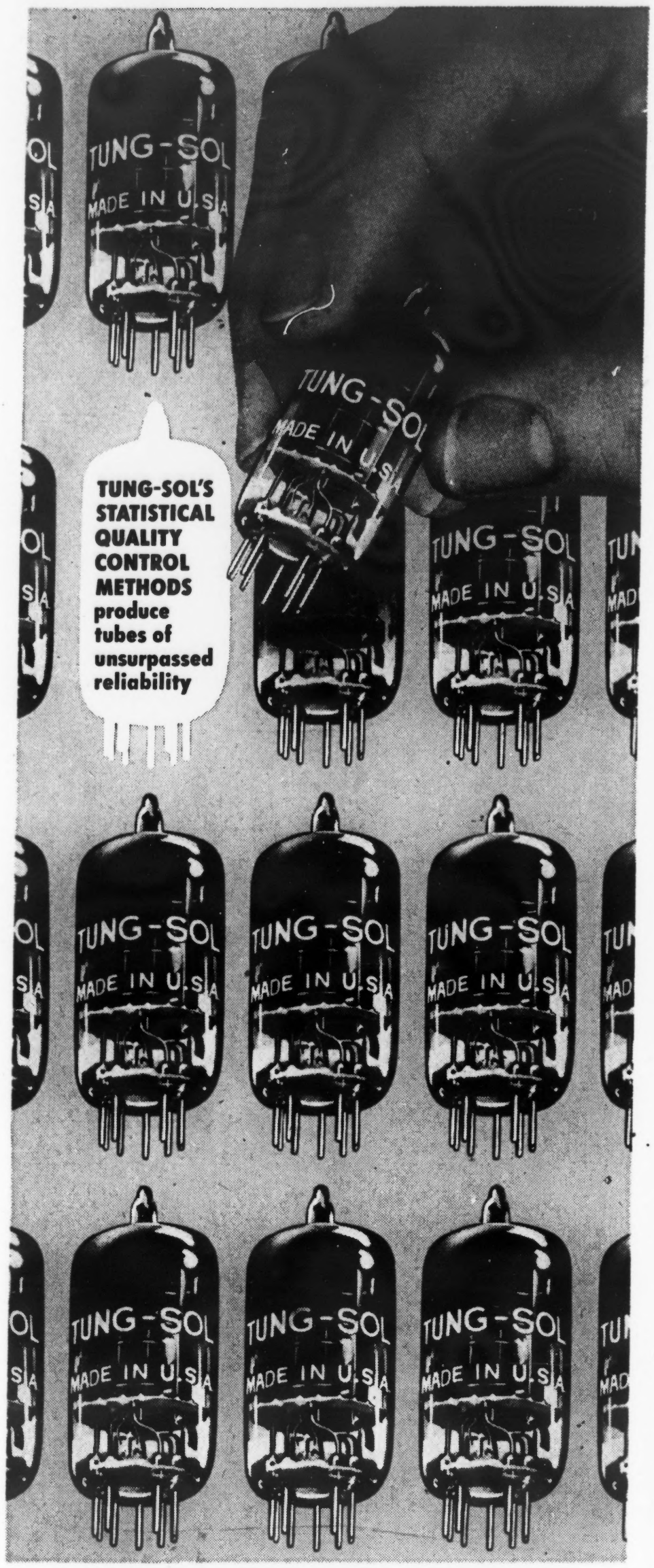
You are looking at the makings of a crash. But it won't happen. Through the darkness a new Aircraft Radar revealed a mountain range directly in the flight path. Now the pilot is climbing to clear it.

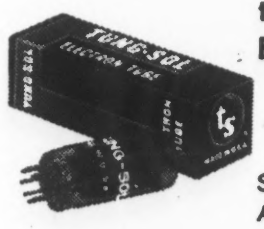
Like a powerful telescope, this advanced-type radar equipment enables the pilot to study obstacles "close-up"—in a choice of five different ranges between 5 and 200 miles. Here is a compact lightweight radar that will readily indicate mountains and near-by aircraft. It can locate thunderheads and other cloud formations—permit the pilot to navigate a safe course. It can map terrains, showing the pilot the salient characteristics of the ground he's flying over. It can help the pilot keep his plane on the desired flight path. It can even be used as a visual check against the landing and approach instruments in his plane.

This new Aircraft Radar, made by RCA for the Navy Bureau of Aeronautics, is another technical achievement worked out in close co-operation with the military to insure U.S. supremacy in electronics. Meet the RCA engineers and field technicians in your branch of service.

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Churchill Cabinet Company Enters Its 50th Year of Manufacturing Wood Products

On August 4, 1904, Ole Gullicksen, then a young man of 37, who had had an early and sound training in the woodworking business, decided that "now is the time" to "go on his own" and in association with a few of his fellow workers took out incorporation papers starting the Churchill Cabinet Company, taking the name of the street upon which the building was located at 2119 Churchill Street in Chicago.

During those days it took plenty of nerve to "go on your own," especially when you had little capital, but Ole Gullicksen had an honest face and the spirit of his Viking forebears and the many suppliers of lumber and finishing materials, as well as machinery manufacturers, were all glad to help this young man.

The trials and tribulations were many and tough, but the will to succeed was there and from that humble beginning a sound, well established business grew to its present size and today, after these many years, the Churchhill Cabinet Company enjoys the reputation of being one of the outstanding firms of its kind (contract woodworkers) in the nation.

Ambition Never Realized

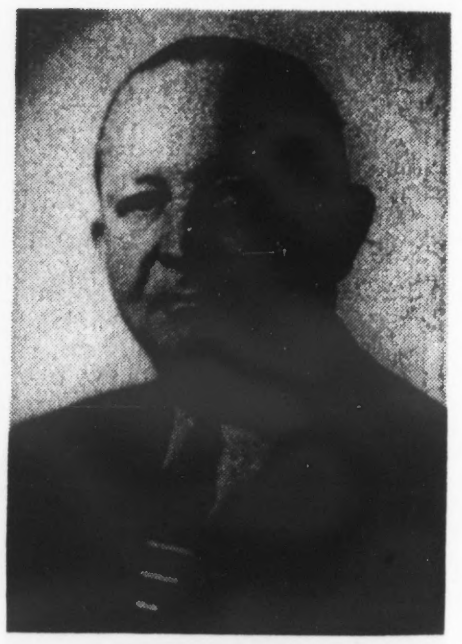
Mr. Ole Gullicksen died in 1948, failing to realize his life's ambition—to see the fruits of his hard work and celebrate the Company's 50th year.

For a great many years two of "O.G.'s" sons were associated with him in the business, both of whom were with their dad during the early years of struggle when the business was being built to its present standing and today, with that sound training of doing it the "hard way" these sons are carrying on the wonderfully sound fundamentals laid down by "O.G.". Spencer T. Gullicksen is President and Treasurer and Willard A. Gullicksen is Vice President and Secretary. In recent years their brother, Rowland H. Gullicksen, joined them and is Assistant Treasurer and Director of Purchases, making a smooth running team.

The Churchill Cabinet Company manufactures, as it has for many years, a complete line of telephone booths, both for inside and outside use. They also manufacture, by contract, telephone boxes and switchboard cabinets; TV and radio cabinets; electronic organ cabinets; display cabinets; juke boxes, and, as a matter of fact, anything made of wood—from "toothpicks to telephone booths."



O. Gullicksen, 1867-1948
Founder of the Churchill Cabinet Company.



S. T. Gullicksen
President of the Churchill Cabinet Company.

WHAT has a vacuum cleaner to do with defense production?

Lewyt is *first* and *foremost* a Government contractor—*permanently* in war and peace.

Has been since 1914.

And, becoming one of the country's largest vacuum cleaner manufacturers in the last 5 years has made us an even *better* Government contractor

. . . bigger . . . more flexible!

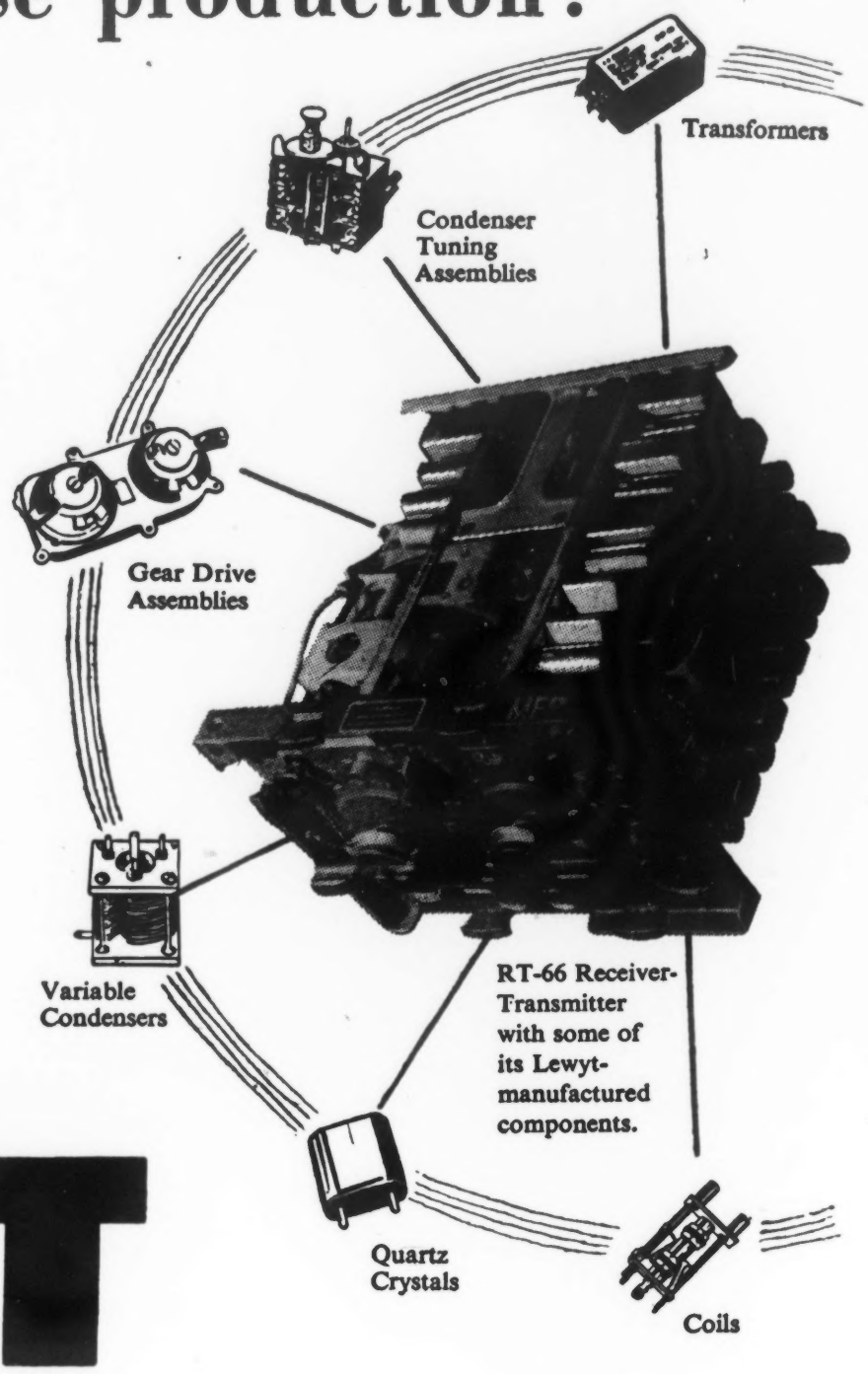
From where Uncle Sam sits, it means a steady force of 1,500 trained workers available at all times

. . . busy in peace

. . . ready overnight to throw their full weight into emergency production.

It means expanded facilities—faster, more economical tooling-up; a way to help defense budgets go further through lowered costs.

The RT-66 Receiver-Transmitter and its Lewyt-manufactured components, illustrated, is a good example of another advantage of our dual operation—*integration!*



LEWYT

We not only produce this Receiver-Transmitter—but actually manufacture 65% of its components!

. . . crystals

. . . transformers

. . . condensers

. . . RF coils . . . chokes

. . . gears . . . chassis . . . housings . . . precision machined parts

. . . we make 'em all!

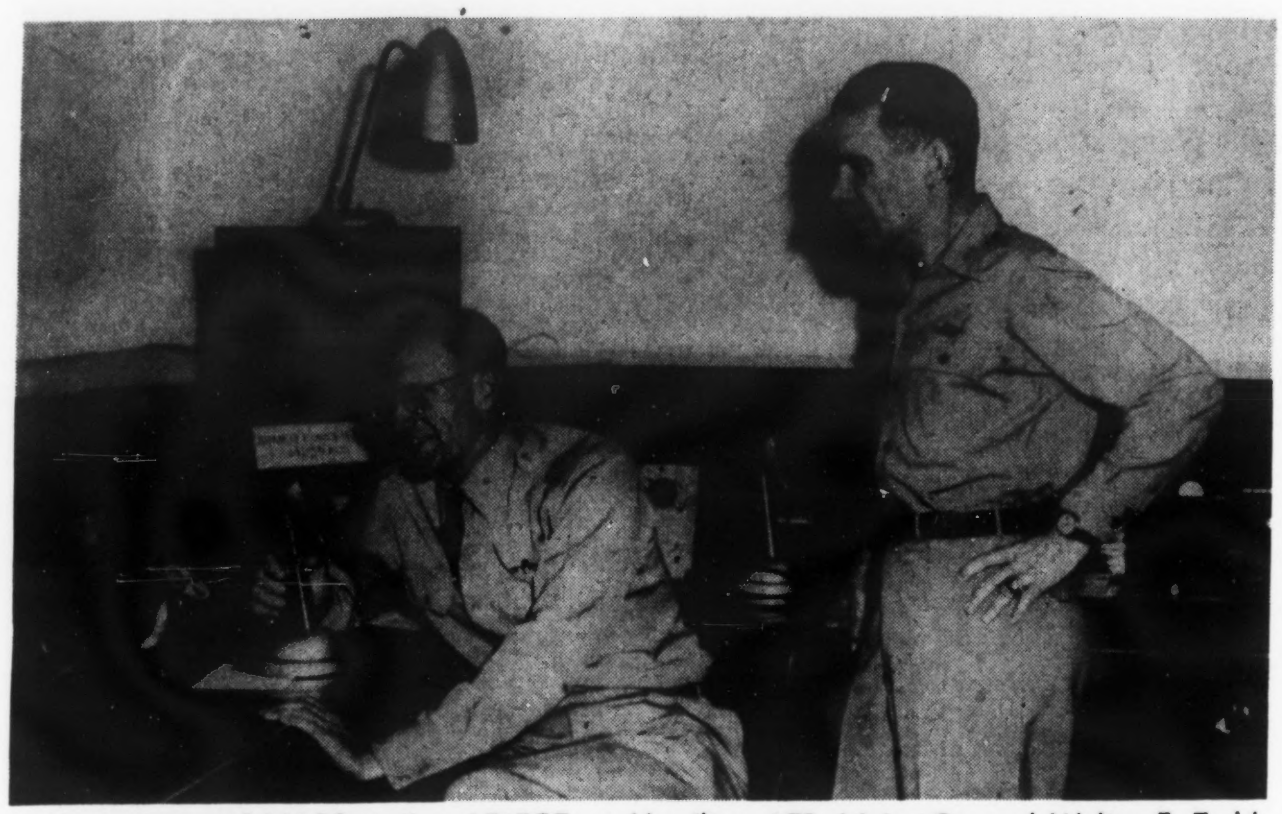
It's called integration, but what it boils down to is deliveries on time, control of quality—and reduced costs through elimination of countless "double profits."

A vacuum cleaner has *plenty* to do with defense production!

LEWYT • • • *Manufacturer of Electronic and Electro-Mechanical Equipment Since* 1888

LEWYT CORPORATION, BROOKLYN 11, NEW YORK

Radio Military Amateurs



At the opening of MARS station AF6FCT, at Hamilton AFB, Major General Walter E. Todd, Commander of the Western Air Defense Force, and Brig. General James W. Andrew, 28th Air Division commander, inspected the equipment. Above, General Andrew sends a message as General Todd looks on.

New MARS Station at Hamilton AFB

MARS Station AF6FCT, Headquarters, Western Air Defense Force, and Headquarters, 28th Air Division (Defense), has been activated at Hamilton Air Force Base, Hamilton, California. With the combined equipment of the two headquarters, AF6FCT is capable of efficient MARS and amateur operation in the establishment of MARS nets and Ham traffic schedules.

The three position console features two 32V2 transmitters, 75A2 receivers, package stations, one each for 3307.5 kilocycles 28th Air Division net, and 7560 kilocycles, Western Air Defense Force net. The third is the position from which a BC-610-F on 20 meters and a Globe King 400B on 75 meters are controlled. An SP-600-JX is the receiver for the Ham traffic handling position.

A vitally important part of the station is the radio-teletype unit, the new AN/GRC-26A. Daily schedules on 7140, with members of the Southern California Radio-Teletype Society, funnel traffic into the area represented by that Club. Full scale operation on MARS channels with AIR, Washington, D. C., AI1AA, Tokyo, Japan, and AK1AA, Anchorage, Alaska, is in the planning stage at present, and should be underway soon. The efficient handling of military and amateur traffic by radio-teletype is a reality and should be exploited to the fullest degree by all with facilities for radio-teletype.

Official, quasi-official and personal messages in the continental United States and from overseas for morale purposes are another phase of operation in this station.

Construction and repair of equipment is accomplished in the large combination shop and classroom. At night, classes in theory and code are conducted, with the goal in mind of procuring amateur licenses for the students.

In case of power failure, a 30-kilowatt auxiliary generator stands ready to supply power to the station for emergency operation.

Station Director of AF6FCT is Captain John B. Kelley, from Novato, California. T/Sgt Robert L. Prather, Jr., W6RDW, Fresno, California, is NCOIC. T/Sgt Rolland W. Bucklew, W9WSI, from Chicago, Illinois, and S/Sgt Arthur J. Kratz, W6UOM, Milwaukee, Wisconsin, are trick chiefs of the swing and day shifts respectively, with S/Sgt Raymond Lunsfor, from Newburg, Oregon, and A/1c Kurt Borchers, Stockton, California, MARS frequency operators.

Colonel John C. Alison, Director of Communications and Electronics, Headquarters 28th Air Division, was one of the large contribtuors to the activation of MARS Station AF6FCT.

ARRL Appeals to TV Industry

The American Radio Relay League has requested the cooperation of the television receiver industry and the Federal Communications Commission in alleviating a new problem of television interference arising in sets converted for the u.h.f. band by means of channel strips.

The League points out that the dual-conversion strip system, while an ingenious expedient, fails to meet the engineering principles laid down by FCC as necessary to provide an interference-free service in the u.h.f. bands. Such "converted" receivers became susceptible to interference from innumerable other services in the general region 108-174 Megacycles. The League notes that in more than half of the u.h.f. TV channels there is considerable possibility of interference from amateurs properly operating in their 144-Megacycle band.

ARRL, in a letter to industry, asks that TV manufacturers using such a conversion system in their receivers take necessary steps to service the problem where it arises. In another letter, to FCC, the League requests that the Commission's field organization make it perfectly plain both to the public and to industry where the fault lies in cases of interference

Check the specs...
Check performance...

Then, They'll Choose Hallicrafters

Do you know any better way, any other way, to judge SW equipment than to check the specifications and the performance? Frankly that's the only valid way we can think of to make sure you get your money's worth. Check these specs. Take a look at the selectivity curve for the S-76. It is typical of the outstanding value Hallicrafters offers in every price class.



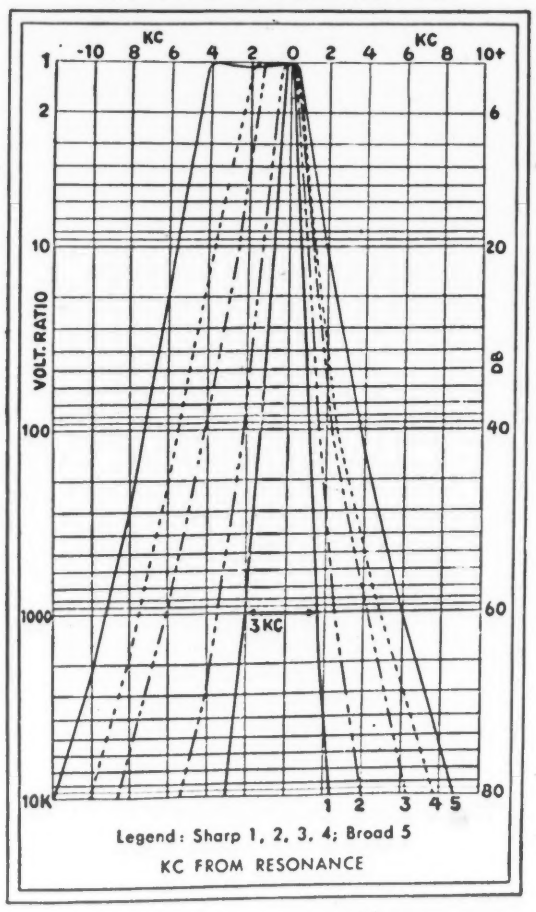
Model S-76

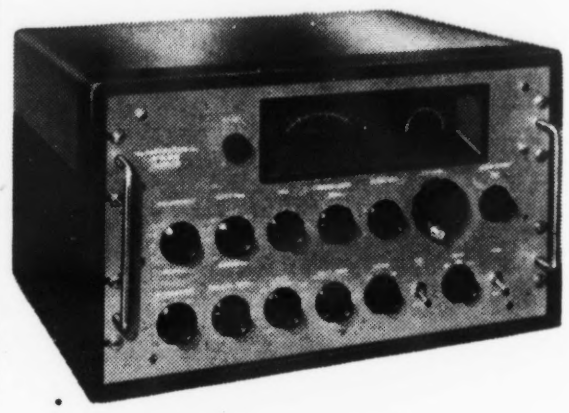
Double conversion receiver. Broadcast Band 538-1580 kc plus three short-wave bands covering 1720 kc-34 Mc.

Calibrated electrical bandspread for easy tuning. Double superhet with 50 kc second i-f and giant 4-inch "S" meter. Five position selectivity, one r-f, two conversion, two i-f stages, temperature compensated. 3.2 or 500 ohm outputs.

Satin black steel cabinet. 18½" x 8⅞" x 9½" deep. Nine tubes, voltage regulator, and rectifier. For 105/125 V. 50/60 cycle AC. Use R-46 speaker. . . $199.95

SELECTIVITY CURVES, S-76





Model HT-20. T.V.I. suppressed 100 watt AM-CW transmitter with all spurious outputs above 40 Mc at least 90 db. below full rated output.

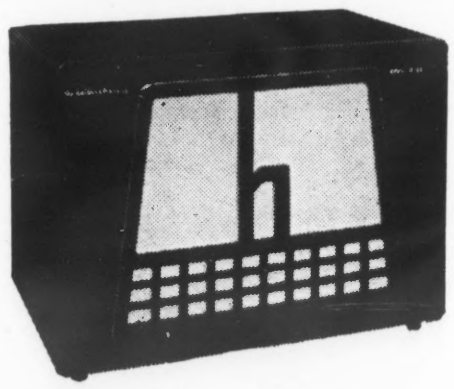
All stages metered; single meter with eight position meter switch; output tuning indication. Frequency range of 1.7 Mc to 31 Mc continuous on front panel control. Seven tubes plus five rectifiers. For 105/125 V. 50/60 cycle $449.50

Model SX-71. Covers Broadcast Band 535-1650 kc plus four short-wave bands covering 1650 kc-34 Mc. and 46-56 Mc.

Narrow Band FM one r-f, two conversion, and three i-f stages. Temperature compensated, voltage regulated. Three watt output (terminals for 500 and 3.2 ohms).

Satin black steel cabinet. 18½" x 8⅞" x 12" deep. 11 tubes plus regulator, rectifier. For 105/125 V. 50/60 cycle AC. Use R-46 speaker. . $249.95





Model R-46. Matching 10" PM speaker for use with Hallicrafters communications receivers SX-71, SX-76, SX-73 or SX-62. 80 to 5000 cycle range. Matching transformer with 500-ohm input. Speaker voice coil impedance, 3.2 ohms.

Satin black steel cabinet matches all Hallicrafters receivers. Cloth covered metal grille. 15" x 10⅞" x 10⅞" deep. Ship. wt. 17 lbs. . $24.95

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World's Leading Exclusive Manufacturer of Communications and High Fidelity Equipment, Radio and Television

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from this source. The League's view is that the amateur service will not "go through another difficult period, again not of its own making, carrying the burden of public misunderstanding and abuse which arises solely because of the inadequacy of television receiving apparatus."

DISASTER PLANNING

A great deal has been said in the past about the desirability of Naval Reserve activities cooperating with local Civil Defense, the American Red Cross, and other relief agencies in providing emergency communications during times of disaster. At least one individual has done something about it. He is LCDR. Irby H. Boyd, USNR, W4CRP, attached to Naval Reserve Training Center, Memphis, Tenn. As Civil Defense Radio Officer for Memphis and Shelby County, Tennessee, Boyd has donated his services in organizing 50 radio amateurs into a closely-knit emergency communication network in that area.

The network consists of 40 mobile and ten fixed amateur radio stations. Amateurs participating, some of whom are Naval Reservists, are: W4's — BAQ, BCA, BOR, BS, CV, DCH, DIX, DQH, EM, EWC, FCF, FEB, FG, FK, GQQ, GYS, HCU, HHK, IBG, IIY, IQX, JOW, KGN, KGQ, LRO, LVG, LVJ, LVW, LYX, NMM, NZP, PKI, POW, PBG, ROS, SCF, SII, SUH, TBJ, THO, UCA, UFH, VVQ, VZU, VZV, WCB, WSP, WWV, YMB.

LCDR. Boyd and his group have reason to be proud of their resourcefulness and contributions in the public interest.

ACS ANNOUNCES CHANGES IN MARITIME RADIO FREQUENCIES

International frequency allocation treaties which have been recently concluded necessitate a change in radio transmitting frequencies of all Alaska Communication System fixed coastal radio stations in the maritime mobile radiotelephone service, Colonel M. R. Kunitz, Commanding Officer of the System said today.

The change became effective 1 November 1953.

The following ACS stations operating in the Alaskan Coastal Harbor Service are affected: Ketchikan changed from 2960 kc to 2300 kc; Cordova and Valdez from 2970 kc to 2300 kc; Anchorage, Barrow, Craig, Cold Bay, Naknek, Petersburg, Seward, Sitka, Skagway, Unalaska, Whittier and Wrangell from 2970 kc to 2312 kc and Juneau, Kodiak and Nome from 2970 kc to 2784 kc.

Mars Radio Station AJ3AN Serves Members of US EUCOM

A new addition to the MARS radio family has been established at the Headquarters of the United States European Command.

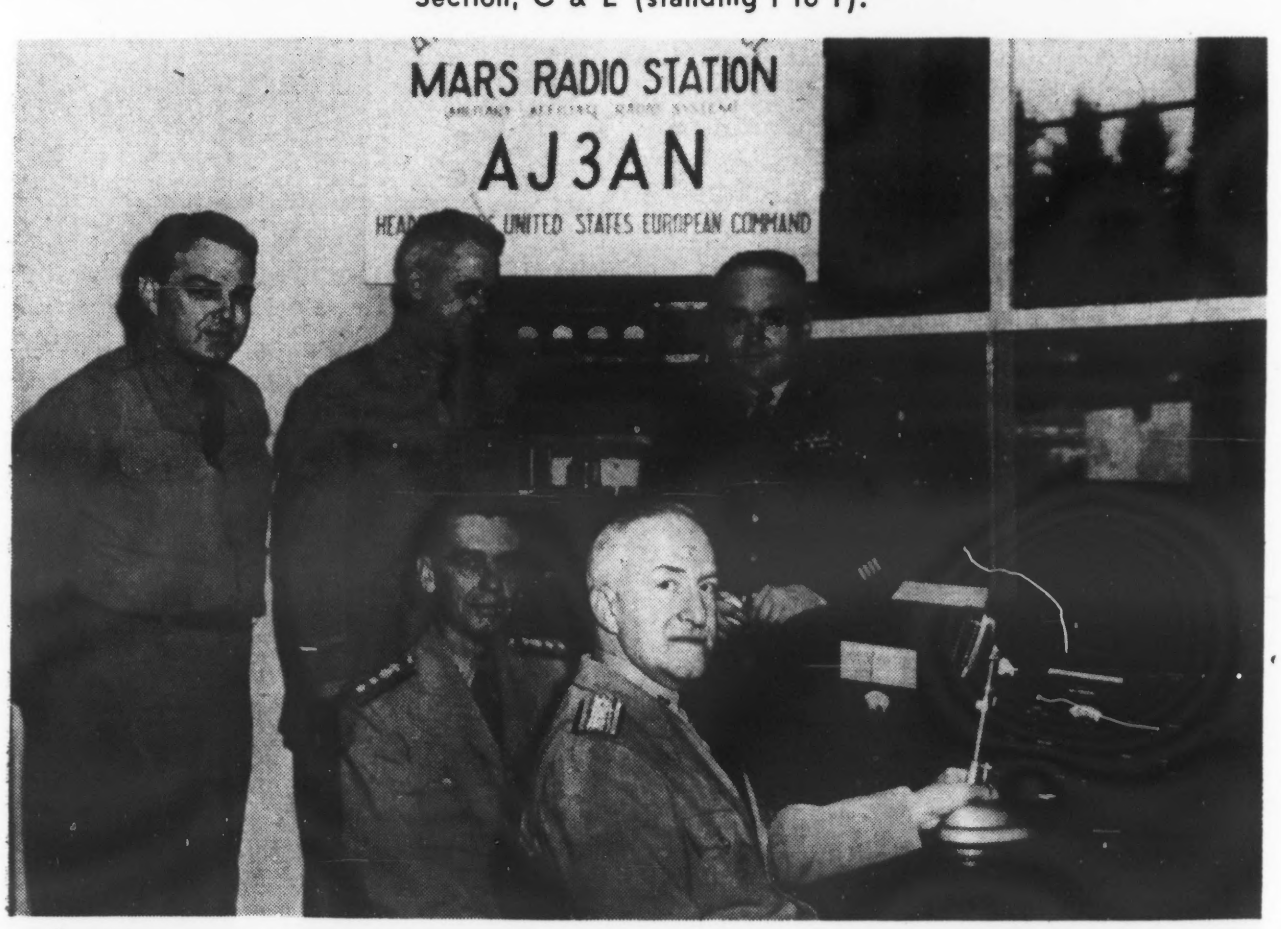
Station AJ3AN serves members of US EUCOM. Colonel William R. Weber, USAF, (AJ3BF) has been named MARS station director. Lieutenant Colonel William T. Hodson, USAF, (AJ3CL) is assistant director. Colonel Carl Hatch, Army Signel Corps, (A4IIT), Deputy Director of Communications, actively assisted in the establishment of the EUCOM station.

AJ3AN has a Collins 30-K transmitter and a 75A-2 receiver. A current-fed flat top antenna, 130 feet above the ground on the I. G. Farben Building, permits operation on all amateur medium frequencies.

A radio club is being formed within the headquarters and will go on the air with amateur call sign DL4WP. It is planned to offer instruction in radio theory and in code practice through facilities of the radio club.

formerly vice-president and director of the AFCA, former Director of Communications at US EUCOM, sponsored the establishment of AJ3-AN. His successor, Rear Admiral Joseph N. Wenger, USN, was on hand for the station dedication in September.

Headquarters U. S. European Command's new MARS radio station is inspected by: Rear Admiral Earl E. Stone (seated front), outgoing Director of Communications and Electronics Division; Rear Admiral Joseph N. Wenger (seated rear), new C & E Director; Colonel William Weber, USAF, Deputy Director Morale and Welfare Division; Colonel Carl H. Hatch, Deputy Director C & E Division; and Lt. Colonel William T. Hodson, Chief Facilities Section, C & E (standing l to r).



Television Interference Studied

A demonstration of the causes and cures for interference to television reception was staged by the American Radio Relay League staff at meetings for service technicians and amateur radio operators in fourteen major Eastern cities during the past two months.

Picture interference from electric shavers, carbon-filament light bulbs, short-wave radio transmitters, diathermy, and f.m. broadcasts were among the sources which were demonstrated as having distinctive and identifiable patterns. Slide illustrations showed the circuit difficulties and their remedies. Also demonstrated were the manner in which some television receivers interfere with other radio services, and on occasions even with themselves.

The League undertook the tour as a matter of informing service technicians about interference problems, and to correct their practice of erroneously identifying any and all picture interference as "probably some amateur."

SPACE ISSY

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WHIP ANTENNA
FOR BOATS

WALKIE TALKIE
ANTENNA

HANDIE TALKIE
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FIELD SET ANTENNA

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PHOTOGRAPHY

NEW DEVELOPMENTS IN PHOTOGRAPHIC PROCESSES AND MATERIALS

An engineer of the Signal Corps Engineering Laboratories discusses four recent developments in the field of photography: electrostatic electrophotography, photosensitive plastics, photothermography, and stabilized processing.

Significant progress has been made in the electrostatic electrophotographic process along several lines since it was first described and demonstrated before this section about two years ago said Mr. Steven Levinos of the Signal Corps Engineering Laboratories, Fort Monmouth, New Jersey, in an address delivered to the New York Section, Technical Division, Photographic Society of America recently.

Mr. Levinos stated that notable among these are the following:

1. The electrophotographic plate (which replaces conventional film) can now be satisfactorily sensitized in approximately five seconds.
2. The photographic speed of electrophotographic plates is now roughly equal to that of Plus X film.
3. Electrophotographic plates recently perfected have panchromatic response.
4. An electrophotographic latent image can be developed to yield a high quality powder image in one second or less.
5. Fifty-six lines per mm can be resolved in the powder image on a developed electrophotographic plate.
6. The electrophotographic process can be used to take pictures in fields of nuclear radiation.
7. The development of new materials to replace the selenium now used holds promise in the direction of extending response in the infrared region beyond the spectral sensitivity of infrared sensitized silver halide emulsions.

Continuing, Mr. Levinos stated that the new field of photosensitive plastics has shown great promise in the production of good quality photographs. This process is based upon a system of photosensitive plastics (polyvinyl chloride) and involves a heating operation after exposure of the plastic to develop the latent image while at the same time desensitizing the unexposed areas so that subsequent exposure to light is without effect. Fundamentally, the system depends upon the liberation of hydrogen chloride (dehydro-halogenation) from the long polymer chains, and this in turn can initiate any one of four possible reactions to produce a visible image on subsequent heating. These reactions are as follows: degradation of the polymer; formation of a dye "in situ"; formation of a pigment "in situ" and bleach-out of dye components to yield a direct positive image.

Another development covered in Mr. Levinos' talk concerned photothermography and photothermographic compounds, which are chemical compounds that can be made to change color after exposure to light, by heating. Such compounds when prepared as emulsions, were initially found to be slow as compared to conventional materials, having a response equivalent to that of diazo materials, and possessed a spectral response essentially confined to the near ultraviolet. The most sensitive of these compounds, mercurous oxalate, has now been improved both in speed and spectral response having been extended to the yellow region of the spectrum by the use of sensitizing dyes. Solid solutions of silver and mercurous oxalates have shown even greater promise with regard to overall speed.

Experiments have revealed the presence of desensitizing gases (produced as a result of slow decomposition) within the emulsion layers. Suitable chemical additives and changes in preparative techniques have largely eliminated this problem. The outstanding remaining problem is that of fixation (comparable to the fixing of conventional films or prints with hypo). Here too, a possible solution has been provided through a study of the chemical reactions involved. It is a bit premature at this time to predict what success may be expected in this direction, although the processes in mind are based upon sound chemical principles.

A new rapid method for the processing of photographic films and prints, designated as stabilized processing has been developed as a result of an accidental laboratory discovery, stated Mr. Levinos in the concluding part of his talk. Stabilized processing is based upon the fact that unexposed silver salts may be rendered light transparent and light insensitive, and hence allowed to remain in the emulsion layer, by the complexing of these salts with thiourea, the chemical used for stabilizing.

In practice, a neutral amidol developer used for both film and paper, of reasonably good keeping quality, a simple hardening bath of chromium ammonium sulfate for film, a simple solution of sodium bisulfite as a stop bath for paper, and a solution of thiourea containing glycerin, for both film and paper, constitute the required chemicals.

Mr. Levinos indicated that films and prints processed by the stabilization technique, although not of archival quality, exhibit a good degree of permanence and that successful techniques have been worked out for the conversion of stabilized films and prints to archival quality.

Wide Screen System for 16mm Motion Pictures

Bell and Howell Co. have announced development of a new 16mm wide screen system which consists of a single anamorphic or "squeeze" lens attachment which can be used for both taking and projecting the wide pictures. The projected picture, which is claimed to be of normal brilliancy, fills a curved screen which is 2½ times as wide as it is high. This expanse is said to cover more nearly the normal field of view of the human eye. With the anamorphic system, it is stated by the manufacturers that a strong sense of depth and participation by the viewer in the scene is created without the use of special viewing glasses. Further illusion is gained also by the addition of three-dimensional or stereophonic sound coming from various parts of the screen. The three-dimensional sound used by Bell and Howell is a modified version of their magnetic recording system used to record the magnetic sound tracks as well as



Du Mont scientists watch electronic instrument tests of a new Du Mont development which will improve all television, in broadcasting studio equipment, in home receivers, and in industry. Shown watching Du Mont Television Network are Dr. Allen B. Du Mont, President (center), Dr. Thomas T. Goldsmith, Jr., Director of Research (right), and Stanley Koch, Head of Du Mont Tube Development Laboratory. Picture on screen from an Eastman Kodachrome Slide.

Du Mont

First with the Finest...*past, present and future!*

DR. ALLEN B. DU MONT, "the father of modern television," completed the progress of generations of scientists who knew that popular television *must* come true.

With his development of the electronic cathode-ray tube, 22 years ago, he made electronic home television commercially practical.

Many more scientific advances followed quickly from the Du Mont Laboratories . . . precision electronic instruments for science and industry, great developments in radar, the first all-electronic home television receivers, the first major television station, the first wholly owned network.

When you see the excellence of *all* television today... thank the thirst for perfection of Dr. Du Mont.

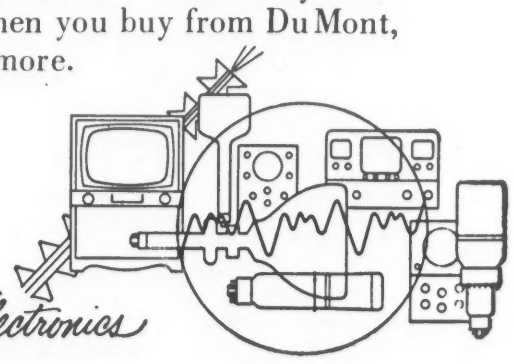
Thank his will toward public service, too. For, at a time when any television set could find a ready market, Du Mont science and research continued to lead and inspire the industry to ever-greater achievements.

For instance, the first big-picture tubes came from the Du Mont Laboratories—years ahead of others. The first automatic full-width Selfocus* tubes by Du Mont were the greatest single advance since the first sets were sold.

And the Du Mont development of economical cameras, station equipment and transmitters—all planned for thrifty "growth without obsolescence"—has encouraged new television stations around the world.

Today Du Mont research and development are more productive than ever before. Outstanding Du Mont scientists—specialists in every branch of television and allied electronics—concentrate their varied skills and knowledge to benefit every Du Mont product and service.

That is why Du Mont "telectronics" will always lead the industry. That is why, when you buy from Du Mont, your money will *always* buy more.



DU MONT®

first with the finest in Television and Electronics

*Trade Mark

Allen B. Du Mont Laboratories, Inc., 750 Bloomfield Avenue, Clifton, New Jersey.

project the film. Two different sound tracks are recorded side by side on a single strip of magnetic material permanently bonded to the film edge. The tracks are played back through separate speakers.

Society of Photographic Engineers To Hold 1954 Symposium At West Point

The Society of Photographic Engineers, Washington, D. C., have announced that they will hold their annual Symposium for 1954 at The U. S. Hotel Thayer, West Point, New York, May 26, 27 and 28, 1954.

It is planned to present some 30 technical papers covering the field of Photographic Engineering and to provide a large and varied exhibit of some of the latest equipment and accessories in this field. Everyone interested is urged to attend.

The 1953 Symposuim was held at this location and the response was so large and enthusiastic that the officers of the Society have decided to hold it there again in 1954.

Persons desiring to present a technical paper should directly contact Mr. Steven Levinos, Engineering V.P. of the Society and Chairman of the Papers Committee, 278 Sandy Hook Avenue, Belford, N. J.

Persons desiring exhibit and other information should contact Mr. Peter Krause, Chairman of The Symposium Committee, c/o Ansco, 405 Lexington Avenue, New York, New York.

Some of the Recommendations were: use of larger overlay plates; use of more distinctive colors for Loran lines and inclusion of all possible Loran lines since several stations were receivable but the appropriate Loran lines were omitted from the plates.

Much of the credit for the work done by the 35th Air Transport Sq. navigators on the test was attributed to Capt. John Harris, project officer.

ANSCO Interested in Buying Pictures

Ansco is interested in buying black-and-white photographs and color transparencies for use in its advertising.

The prices paid for possession and exclusive advertising rights to negatives or transparencies will vary, depending on their value to Ansco and the use to which they are put in the company's advertising programs. Model releases must be available for all identifiable people.

As far as subject matter is concerned, pictures featuring people, particularly young people, are most desirable. As a guide to photographers the company suggests that the pictures have action, human interest and strong poster value. Such subjects as children with animals, a parent with baby. teen-age capers, sports, and other pictures with story-telling qualities, action and popular appeal are best suited for the company's type of advertising.

Since the pictures are intended for reproduction, images should be as large as possible in the picture area. Negative size for black-and-white should be 2¼x2¼" or larger; color transparencies should be no smaller than 2¼x2¼". All pictures must be made on Ansco film.

All pictures should be sent to the Advertising Dept., Ansco, Binghamton, N. Y. In the case of black-and-white, send unmounted prints not larger than 8x10". When submitting color work, send original transparencies, not color prints.

BETTER PHOTOGRAPHIC LENSES FOR THE SIGNAL CORPS

John C. Thomas, Jr. and Carroll W. Arford in a paper published in the *P S A Journal,* Section B, (Photographic Science and Technique) for August 1953 describe in some detail, the photographic lens specification program developed by the Signal Corps Engineering Laboratories, Fort Monmouth, N. J., for the procurement of photographic lenses by the Signal Corps. A feature of the program is that MIL-Standard-150 for Lenses is used as the basic reference representing accepted definitions, nomenclature, practices and tests. The new specifications, of which some 58 have been completed to date, is their "short form," consisting in many instances of only three or four pages. This is rendered possible by the fact that the many detail requirements as contained in MIL-STD-150 are reduced to the form of tabular data in the specifications.

The authors state that the benefits of this program to the Signal Corps have been extensive and have resulted in the procurement of lenses of uniformly high quality and the elimination of a large number of duplicate stock numbered lenses.

Book Review

METHOD FOR DETERMINING THE RESOLVING POWER OF PHOTOGRAPHIC LENSES. *Francis E. Washer and Irvine C. Gardner. National Bureau of Standards Circular 533. IV and 27 pp. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price $1.00*

Circular 533 supersedes NBS Circular 428, "A Test of Lens Resolution for the Photographer," which was published several years ago and is now out of print. It is designed to provide the photographer with a method for determining the relative performance of photographic lenses based on their image-forming qualities.

Accompanying Circular 533 are a set of two sheets of charts by which the resolving power of a photographic lens may be numerically measured with respect to a definite scale of values. These new charts supersede the charts which formerly acompanied Circular 428. Circular 533 gives a detailed description of the procedure and technique to be followed in order that comparable values may be obtained by different observers using these charts.

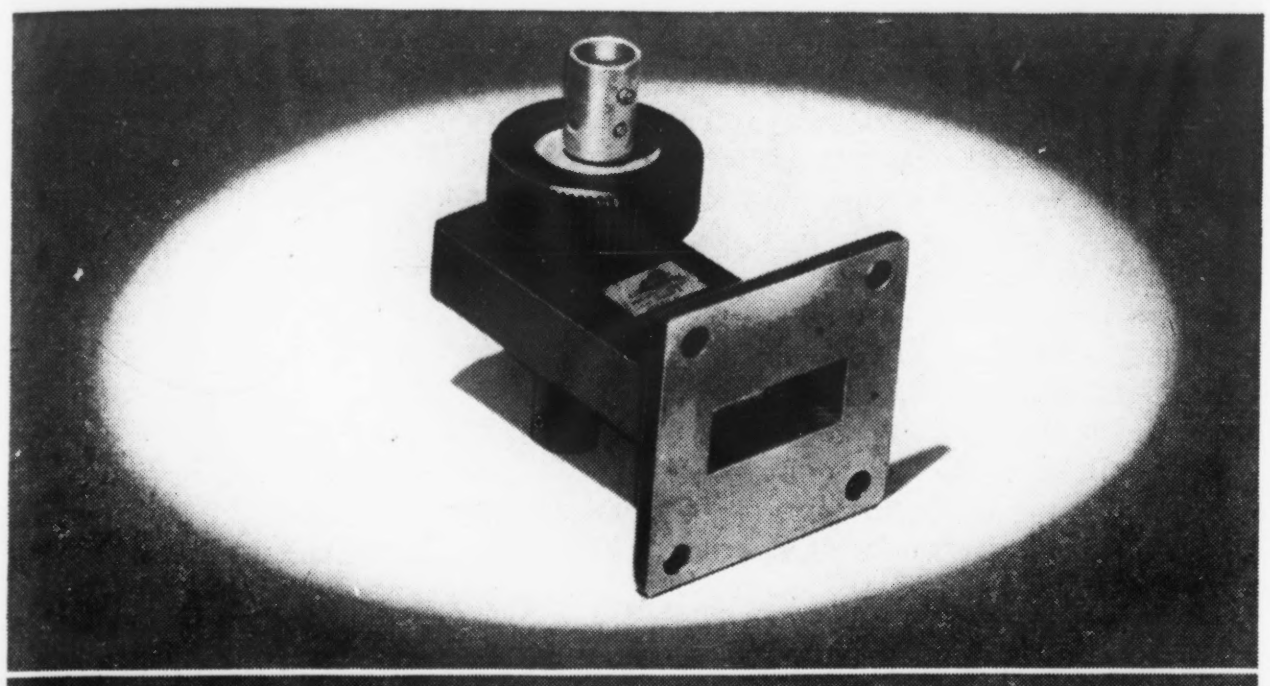
The test provides an objective method of testing a photographic lens. The charts are available in two values of contrast, high and low, and consist of six patterns on each sheet. The six patterns on one sheet are printed in black ink on a white background to form a high-contrast chart. The six charts of the other sheet are printed with gray ink on a gray background to form a low contrast chart. In addition to their use as photographic lens resolution test charts, they will also be found useful in the testing of a variety of other optical equipment such as telescopes, binoculars, goggles, and sunglasses. The charts may also be purchased separately from the circular at 75c for a set of two sheets.

Well written, profusely illustrated, and authoritative, Circular 533 is a new and fitting successor to its predecessor and it is believed that it will prove a useful and convenient reference for all those engaged or interested in a precise method for determining the image qualities of lenses.

New X-Band Test Equipment

ADDITIONAL INSTRUMENTS

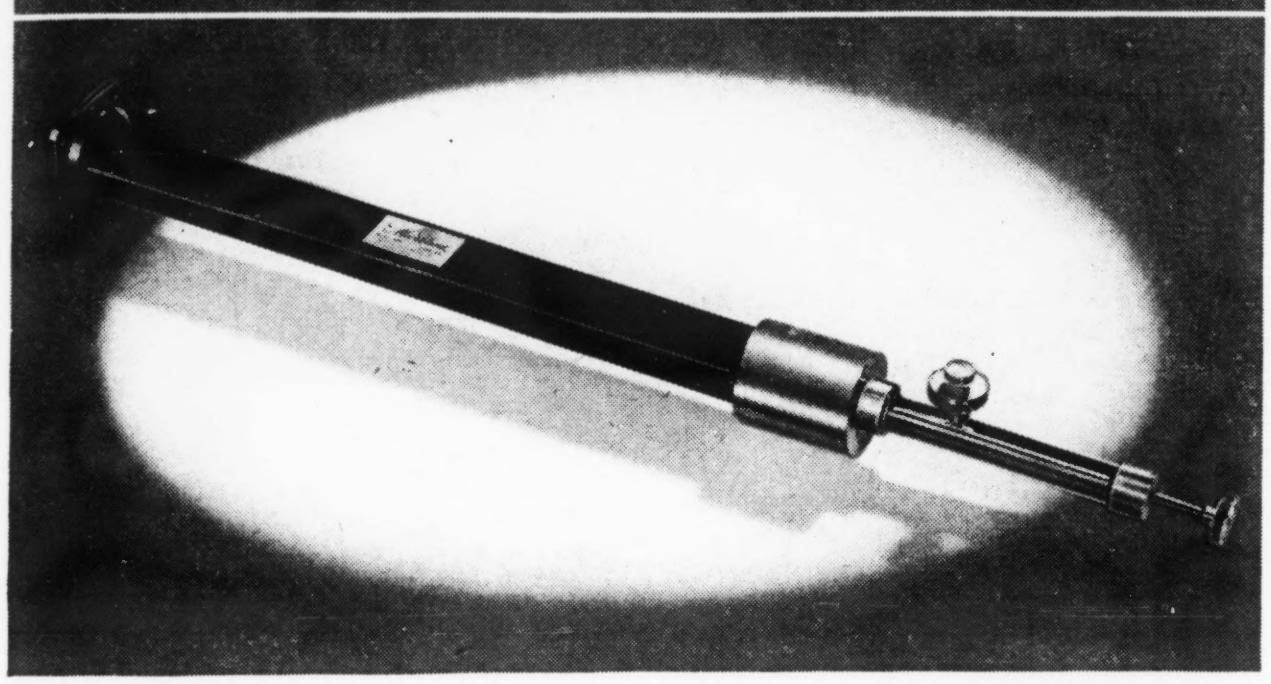
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Model 219C Waveguide Thermistor Mount

This instrument is used in conjunction with accessory equipment to measure and monitor microwave power at average power levels as low as 10 microwatts. It is particularly useful in the measurement of pulsed power. This thermistor mount is recommended for use with the Microline Model 123B Wattmeter Bridge.

Frequency Range	8.5 – 9.6 kmc.
Maximum VSWR	1.5
Operating Resistance	135 ohms
Maximum Power Rating	10 mw.
Waveguide Size	RG-52/U (1" x ½")



Model 495 Adjustable Termination

This instrument is specially adapted for use in precise microwave measurements where the quality of excellent impedance matching over a broad band is essential. The design of Model 495 provides for independent control of phase and amplitude of the reflection coefficient of the load. It is particularly useful in applications requiring a termination of minimum power reflection, a movable termination where the reflection from the termination can cause error in measurements, or as a means of matching low standing wave ratios to obtain the smallest possible reflections.

Frequency Range	8.1 – 12.4 kmc.
VSWR Range	1.005 – 1.15
Phase Variation	360°
Waveguide Size	RG-52/U (1" x ½")
Power Rating	5w.

Our nearest district office will be glad to supply complete information upon request.

*T.M. REG. U.S. PAT. OFF.

OTHER X-BAND MICROLINE INSTRUMENTS

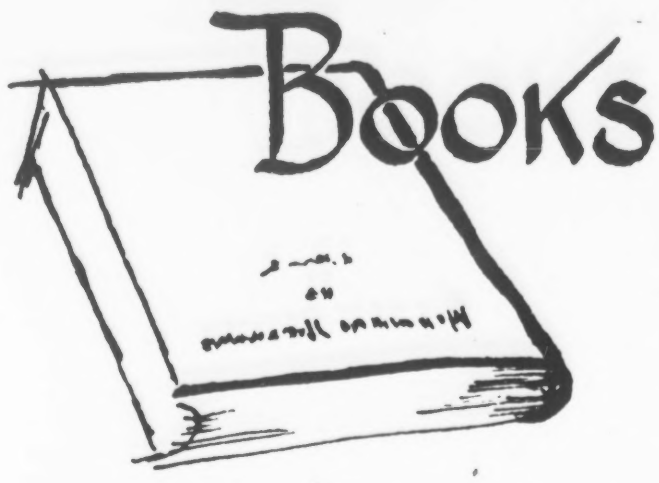
MODEL	INSTRUMENT
167A, 486A	Adapter
377	Adjustable Short
173, 174, 183 152A, 134A	Attenuator
184	Barretter Mount
170, 171	Waveguide Bends
360A	Detecting Section
234, 235, 236	Directional Coupler
126, 273	Frequency Meter
145	Impedance Meter
379	Mixer
165A, 166A	Waveguide Tee
406	Magic Tee
150, 246	Termination
146, 178	Transformer

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REMOTE CONTROL BY RADIO. By A. H. Bruinsma. Philips' Technical Library, Elsevier Press, Inc. 104 pages, $1.50.

As a result of the many questions asked of Mr. Bruinsma during his demonstrations of radio-controlled ships, he has written *Remote Control by Radio* in which all these questions find their answers.

In his demonstrations Mr. Bruinsma utilized two systems: a) an amplitude-modulation system, with two independent channels, hence with limited possibilities; b) an impulse-modulation system with eight channels, making it possible for eight signals to be transmitted simultaneously, but independently, on one carrier wave.

The author has assumed a general knowledge of radio and low voltage technique, but otherwise the use of formulae and mathematics is only very limited. There are circuit diagrams of the transmitters and receivers concerned, details of components needed and plenty of photographs showing the action of working models.

A wide range of people concerned with electronic developments, whether applied to defense research or merely to technical toys, will find this little book of very great interest.

PRINCIPLES OF TRANSISTOR CIRCUITS. By Richard F. Shea. John Wiley & Sons, Inc., New York. Chapman & Hall, Limited, London. 535 pages, $11.00.

Here, for the first time in book form, you will find gathered a large portion of the existing research material on transistor circuits. Written by recognized authorities, it provides basic theory, plus an elaboration of various techniques in the field. It gives a firm background in this rapidly-progressing field, which will permit utilization of new forms of transistors as they appear.

In order to make the book applicable to as many of these devices as possible, the authors use a general treatment, built around generalized equivalent circuits which can be used to conveniently represent the great majority of transistors. After a brief introduction, the book is divided into three parts covering low-frequency, high-frequency, and large signal, nonlinear applications. In each section the same general organization is followed: presentation and analysis of the mathematical relationships, and development of applicable cirsuits. The subject matter is liberally illustrated. Problems and an extensive bibliography are included.

Each chapter is as self-explanatory as possible. Special chapters on duality, matrix methods, and on the application of feedback are included. Resemblances of vacuum-tube circuits are pointed out, and the book uses current network theory modified to fit transitor circuits. It elaborates in detail on the fundamental equivalent circuits for various configurations and for different frequency ranges. It includes material relative to D-C, audio and ultrasonic amplifiers in their various forms and combinations, and includes circuits for utilization of transitors in oscillators, intermediate-frequency amplifiers, and radio frequency amplifiers. Analysis is applicable to both n-p-n and p-n-p units.

ELEMENTS OF ELECTRICITY, 4th Edition. By William H. Timbie and Alexander Kusko. John Wiley & Sons, Inc. 631 pages, $5.50.

The first edition of this book was published in 1910 and since that the basic idea of this book as an elementary textbook has not been altered nor have the basic principles of electrical engineering been changed, but the content of this book has been revised in such a manner as to best reflect the tremendous growth and spread of the electrical engineering industry since that time.

This revision reflects the growth of the industry in the new illustration demonstrating modern practice; in the problems which are more and more based on contemporary applications in electronics and control, as well as in the heavy current industries; and in revisions of and additions to the text material to account for these developments.

Typical examples of the awareness of the progress and change in the industry are the discussions of aluminum wire, ceramic capacitors, transistors, radar, television, dry and gaseous rectifiers.

Since 1910 this book has been doing a outstanding job in helping the teacher to teach and helping the student to learn. As a first text in electricity, it is unparalleled in authority, conciseness, and thoroughness.

ULTRA HIGH FREQUENCY PROPAGATION. By Henry R. Reed; Carl M. Russell. John Wiley & Sons, Inc., New York. Chapman & Hall, Limited, London. 502 pages, $9.50.

An outgrowth of intensive experimental research carried on at the United States Naval Air Test Center, this singular work makes available for the first time to the general field of electrical engineering the most recent information on new developments in the field of Ultra High Frequency radio wave propagation — information which forms the foundation for far-reaching changes in the diverse areas of UHF communication design. Emphasized here is the system approach, and the consideration of the performance of the installation as a whole.

Reviewing the related system parameters, the authors discuss the effect on the entire system of variations in its parts. Much of the material enclosed is devoted to an examination of dynamic system performance characteristics which are present in almost all UHF fields. An important result of this rigorous treatment is the authors' disclosure of some of the deficiencies in installations which have been considered satisfactory from a static point of view.

The book provides a fuller understanding of the relative meaning of such critical factors as reflection, divergence, diffraction, turbulence and directivity. It demonstrates the application of UHF propagation in devices such as radar, television, automobiles, trains and missiles. The book shows the way to a closer approach to ideal installation practice, pointing up the problems of maintenance.

To Be Reviewed

TELEVISION BROADCASTING. By Howard A. Chinn. McGraw-Hill Book Company, Inc., New York. 700 pages, $10.00.

CIRCUIT THEORY OF ELECTRON DEVICES. By E. Milton Boone. John Wiley & Sons, Inc., New York. 483 pages, $8.50.

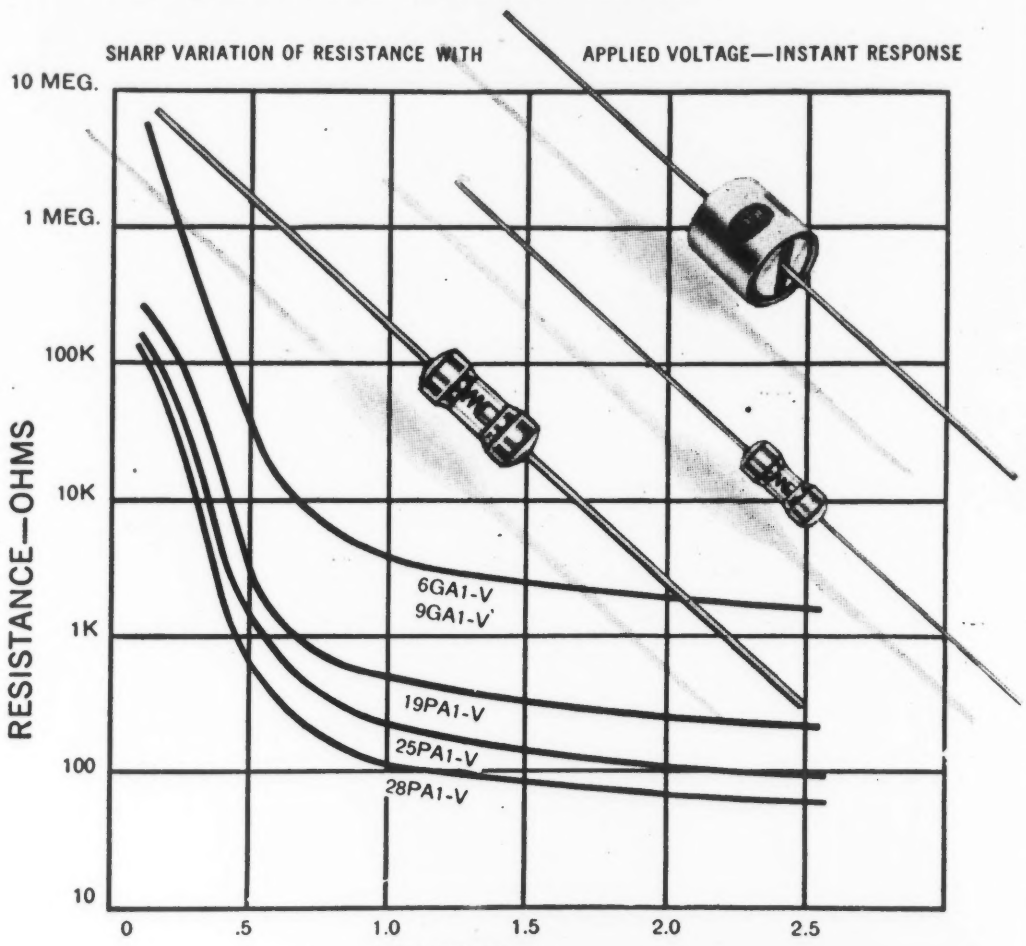
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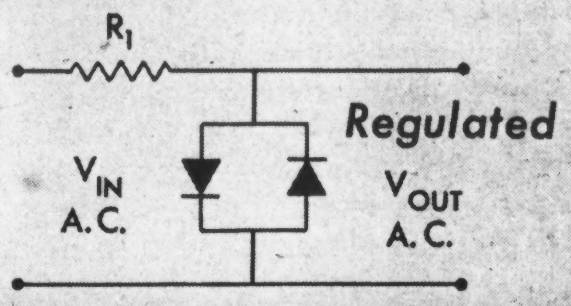
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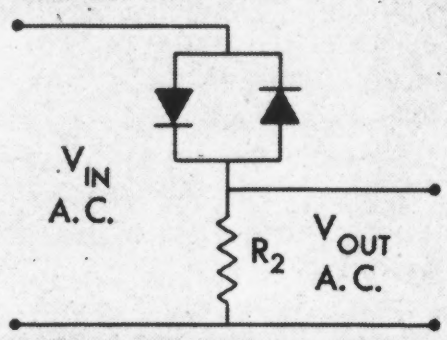


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On Radio Communication and Field Ingenuity

(*Continued from page* 18)

ceiver. Another definition, which may conjure up memories of high school physics, is something to the effect that diffraction is the mechanism by which radio waves bend around edges and penetrate into the shadow region behind an opaque obstacle. Remember the umbra and penumbra, or light shadows? They are part of the same physical mechanism.

Referring to Figure 1, obtained through the generosity of Messrs. Dickson, Egli, Wichizer and Herbstreit, the upper diagram shows the four most possible paths: One is directly over the obstacle; number two is by way of one reflection on both sides of the obstacle; number three is via directly to the obstacle plus one reflection from earth. Four is reflection before the obstacle and then direct to the receiver.

The total contribution via all four paths together adds up to a signal strength as shown on the most rugged curve of the hieroglyphics drawn in the bottom half of the figure.

If we can recover sufficiently from that overly simplified excursion into the realm of the nebulus, let's look into the crystal ball where every thing is so relatively apparent! What does this discovery or rediscovery mean?

First, it has allowed contemporary propagation scientists, at least in this country to my knowledge, to realize acutely how the equally prominent "know-all" people must have felt in Columbus' time when he found the earth to be a sphere.

Secondly, and more important, it means that terrain such as mountains are now viewed with pleasure rather than with trepidations by the radio signal officer. Since most static warfare seems to end up in mountainous country, radio relay will be even more useful — but with a difference.

Instead of trying to locate all relay sites on the tops of the mountains, as is now almost universally S.O.P. (standard operating procedure) relay sites will be located in the valleys. In fact, the new S.O.P. will in all probability be to locate a mountain and shift around it until it is between us and the hot spot needing to be communicated with. Then, we shoot our transmissions at the mountain top and let our radiations, in a manner similar to rolling stones, go down the other side to the receiver in the valley.

Let's hope it results in far less casualties to radio relay crews. At least they are not so exposed as they were on the mountain tops. Let's list this as the most important facet of this discovery.

Before ending this story, let's take a quick look at its effect on civil communications. For some people in mountainous regions, where television and Frequency Modulation reception was thought impossible, use of the "Obstacle Gain" discovery may provide clear pictures and radio signals from transmitters located many miles distant and this distance may be a hundred miles or more depending upon the locations.

Of course, this discovery does not mean that radio relay circuits will work over *any* kind of obstructed path — or that obstructed paths are always preferable to line of sight paths. We are not throwing away the old criteria for siting but adding data on a new and extremely useful method of setting up dependable circuits over longer distances, and over paths hitherto considered completely useless.

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The G. E. Advanced Electronic Center at Cornell University

(*Continued from page* 28)

ter. He served as a staff member of the MIT Radiation Laboratory, acted as a radar consultant to the Air Force, helped organize the Sandia Laboratory at Albuquerque, New Mexico, and has contributed actively to broad study projects in the field of electronic warfare. Prof. Corson is presently engaged in nuclear research, being concerned with the nuclear accelerators at Cornell.

Dr. Lloyd T. DeVore (Ph.D., Physics, Penn. State), who is Manager of Electronics Laboratory (Electronics Division) of the General Electric Company. Dr. DeVore's brilliant professional career includes study of radiation in the range of infrared to ultraviolet, service as Head of the Research Division of the Navigation and Communication Laboratory (Wright Field), Chief Engineer of Special Projects Laboratory (Wright Field), and tenure as Professor of Electrical Engineering at the University of Illinois where he concurrently served as Chairman of the Research Committee and as Coordinator of Research.

Prof. Charles S. Draper (Sc.D., Physics, MIT) who is Head of the Aeronautical Engineering Department and Director of the Instrumentation Laboratory at MIT. Prof. Draper has been active in the fields of flight testing, aeronautical power plants, vibration measurements, aeronautical instruments and control engineering, with special attention devoted to gyroscopic principles and applications.

Dr. George L. Haller (Ph.D., Physics, Penn State), who is Dean of the School of Chemistry and Physics of Penn State and who is one of the founders of the electronics research and consulting firm of Haller, Raymond & Brown, Inc. Dr. Haller served with distinction during World War II in the development of radar countermeasures techniques and of guided missiles. He is at present also serving the Defense Department as a consultant on guided missiles.

Dr. Athelstan F. Spilhaus (D.Sc., Aero. Eng., Univ. of Cape Town), who is Dean of the Institute of Technology of the University of Minnesota. During World War II, Dr. Spilhaus worked with the Signal Corps coordinating research and development of meteorological equipment for the Air Force, in which capacity he was closely involved in the development of virtually all meteorological equipment used by the Army. This involvement included application of radar to weather measurements, storm detection by radar, and many airborne devices for obtaining meteorological data for modern military aircraft.

Expectations Achieved

Thus far, the unusual university-industry experiment known as the General Electric Advanced Electronic Center at Cornell University is verifying the fond notions held by its directors. In a very short time, relatively great strides have been made in various fields of basic research and advanced development, strides which signify a most fruitful future of scientific growth and contributions. These satisfying results are the concomitants of the successful evolution of cooperative and mutually-instructive relationships between the Center and Cornell University. The comparatively small but compact operational structure of the Center has exhibited a flexibility of performance which only a highly integrated yet individually capable group could display.

- - - — - —

Industry vs. the Military on the Manpower Market

(*Continued from page* 35)

"eight-year" obligors; a great manpower pool will be built up of men trained in modern warfare. With this manpower pool, the mobilization concept for the reserve forces can be changed.

In the past, the reserve forces have been composed of a small, select group of volunteers. Thus, a reservist who was a veteran of World War II with a family was as liable to call, in the event of emergency, as a recruit who has never served before.

As the number of reservists was

(*Continued on next page*)

Industry vs. the Military on the Manpower Market

(*Continued from preceding page*)

small, they were trained for use in total war. Military planners thought in terms of total war; partial, Korean-type, mobilization was not envisioned.

During the Korean mobilization, a substantial number of reservists who were World War II veterans shouldered the burden of fighting. They were the only trained men available for the task. At the same time, a great number of young men with no prior military service have remained at home. The inequity of this situation is evident.

However, with the large manpower pool of trained reservists, liability to call can be graduated to the needs of the armed services. From now on, every reservist will be tagged with a mobilization priority. Every member of the reserve forces with a military obligation is now assigned to either:

The Ready Reserve or
the Standby Reserve.

Ready reservists are most liable to mobilization. They are the volunteer firemen of this new plan. They must be ready to go on very short notice. Members of the Standby are not to be called until Congress determines that the military situation demands it.

This can be illustrated by the Korean mobilization. Had the Ready-Standby priorities been in existence when South Korea was invaded, trained fighters would have been available. But selectivity could have been exercised. Veterans who had survived World War II would not necessarily have been called upon to make new sacrifices; but they were available if needed. Men with little prior service would have been the first called.

So, any "partial" mobilization of the future will operate in the same manner. Men with the least previous service will go off to fight while the rest of the Nation continues with its peace-time pursuits. If total war threatens, more manpower can be called. An analogy can be drawn between reserve mobilization and turning on your cold water faucet. In the event of a military emergency the manpower tap can be opened to the desired amount of mobilization. This is a departure from the former concept where the target was total mobilization for all-out war; now the reserve forces can handle any situation from a small "police action" to global war.

(*Continued on next page*)

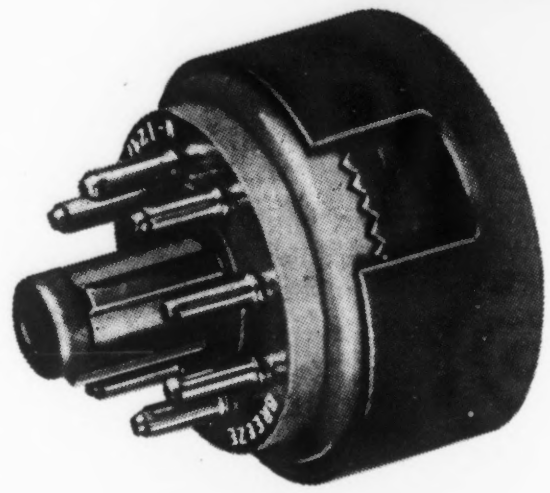


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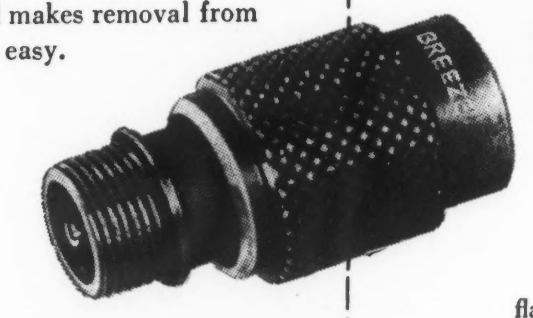
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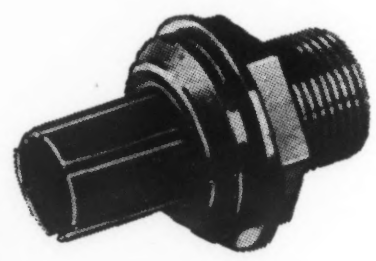
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Industry vs. the Military on the Manpower Market

(*Continued from preceding page*)

This new reserve force is to be no mere "force on paper." It will consist of men trained and equipped for action. This concept is reassuring in that it furnishes the greatest amount of defense protection with the least strain on the nation's pocketbook.

Men with the least prior service are designated as Ready reservists. The draftee released to the reserve forces after completing his two-year tour of active service is assigned to this category. He remains there for the rest of his eight-year obligation unless he *earns* transfer to the Standby.

There are two ways by which an eight-year obligor can earn transfer to the Standby:

First, by performing a total of five years of active military service, or

Second by performing a *combination* of active service and participation in a reserve training program for a total of five years.

Most draftees are not interested in making a career of the military. They want to be released after two years of service, and then reduce their liability to recall, if possible.

Reserve components of all of the Armed Forces have programs affording obligors an opportunity to earn transfer to the Standby. The best of these programs is the organized reserve. In the organized reserve, men are required to attend drills held on the weekends or during the weekdays in the evening. They are also required to attend two-week periods of summer camp.

Under present law, it is not mandatory that reservists participate in any organized reserve training activity. However, pressure is being exerted to require their participation. It is foreseeable that such participation may be required in the future. Teeth could be put in the law punishing any reservist who failed to take part.

Under these circumstances, it is very clear that employers should do everything possible to encourage their reservist-employees to earn their way to a position of lesser liability to mobilization. The employer certainly cannot suffer if his reservist-employee attends the weekly drills of the organized reserve on his own time. However, the employer may suffer some loss if the man attends summer camp.

Today, many employers follow the lead of the Federal Government in allowing its employees an annual period of military leave. The Government authorizes its reservist-employees 15 days of military leave each year; this is in addition to any other leave the man may have accrued. It is up to the employer in private industry to balance the national welfare against his own managerial needs and limitations.

In a recent survey, the Military Affairs Department of the Cleveland Chamber of Commerce asked its members about the military leave policy of their organizations. Here are the results of the survey in which 285 concerns reported:

One hundred eighty-nine concerns grant military leave to its reservists (164 of which give it in addition to regular vacations), 96 have no policy on the matter, and none of them refuse to grant it.

Some of these concerns have gone further in following the policy of the Federal Government. The Government pays a reservist both his regular civilian salary and his military pay while he is at summer training. Besides that, he is guaranteed, by law, that he will not suffer loss of seniority or other rights because of his attendance at annual field training. In the same survey at Cleveland, it was found that 27 concerns pay its reservist-employees full salary while they are at camp, 64 organizations make up the difference between military pay and civilian salary, 80 grant no such pay, 96 have not established a policy on the matter, and 18 have special provisions governing the situation. The survey also showed that some of the firms have no employees of military age. Of the total number reporting, 146 were engaged in defense production.

Employers have another advantage besides their ability to encourage reservist-employees to lessen the latter's liability to mobilization. This second advantage is the new delay policy for reservists that is established by the Department of Defense and is in addition to the Ready-Standby mobilization priorities. Reservists holding key civilian jobs essential to the Nation's welfare may be temporarily left at home if an emergency occurs. Government planners recognize that certain reservists who are key workers must be retained in their jobs long enough to convert industry to war production.

Under this policy, no blanket delays will be given any one group; a reservist-employee or his employer must make an individual request for such consideration. Such a request must be supported by a written statement of justification from the concerned employer.

If a delay is granted, it will only be for a period of six months and may be terminated earlier. It may also be renewed. No indefinite delays are to be given.

Here is a run down on the conditions under which a reservist may be entitled to a delay during mobilization because of his importance in industry.

Critical Occupation

A reservist will be given a delay who is engaged in a critical occupation when:

* His job is classified as being a critical job in an essential industry;
* Retention in his job outweighs the need of the Armed Forces for his immediate services; and
* His mobilization would cause a material loss to the defense effort.

Key Position

A reservist will be given a delay as a key-worker if:

* His job is listed as essential to the national defense effort or he is employed in a governmental activity related to defense;
* His mobilization would cause a material loss to the civilian effort;
* Retention in his civilian job outweighs the need of the military for his immediate services; and
* He occupies a position at managerial level and directs or controls the major part of an organization.

Apprentices

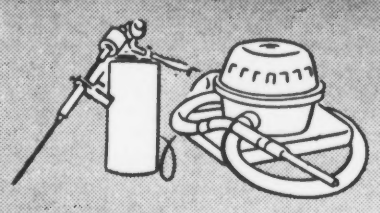
A reservist engaged in apprentice training will be given a delay if:

* The job he is preparing for is listed as a critical job in an essential industry;
* He has completed at least 2,000 hours of such apprentice training;

(*Continued on page* 78)

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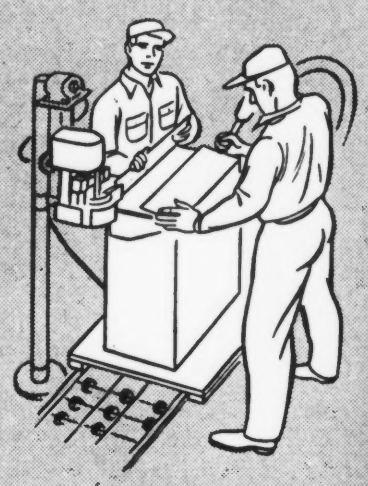
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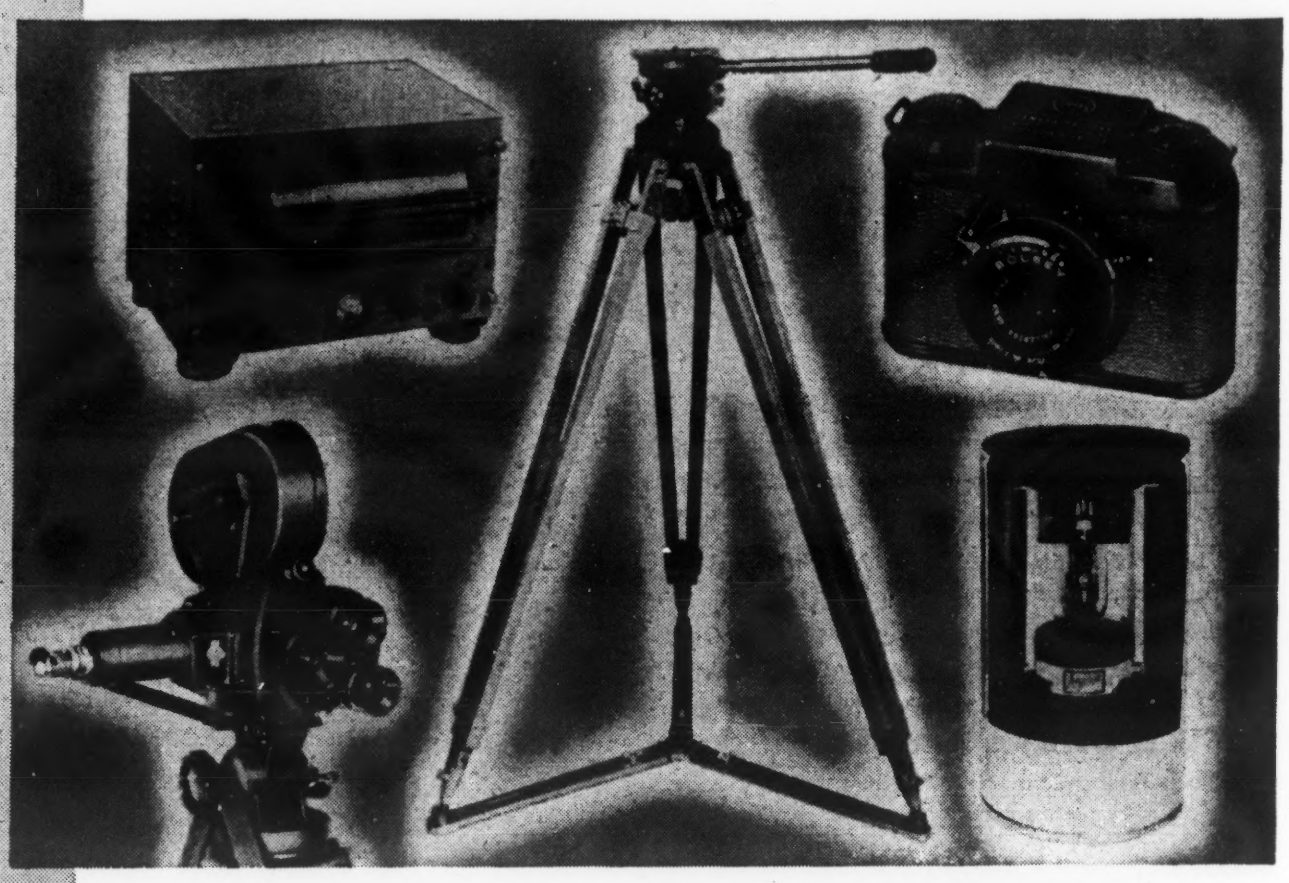
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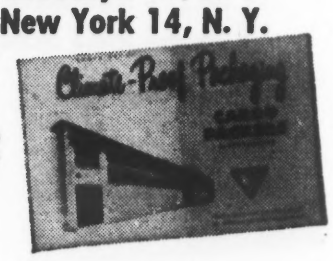
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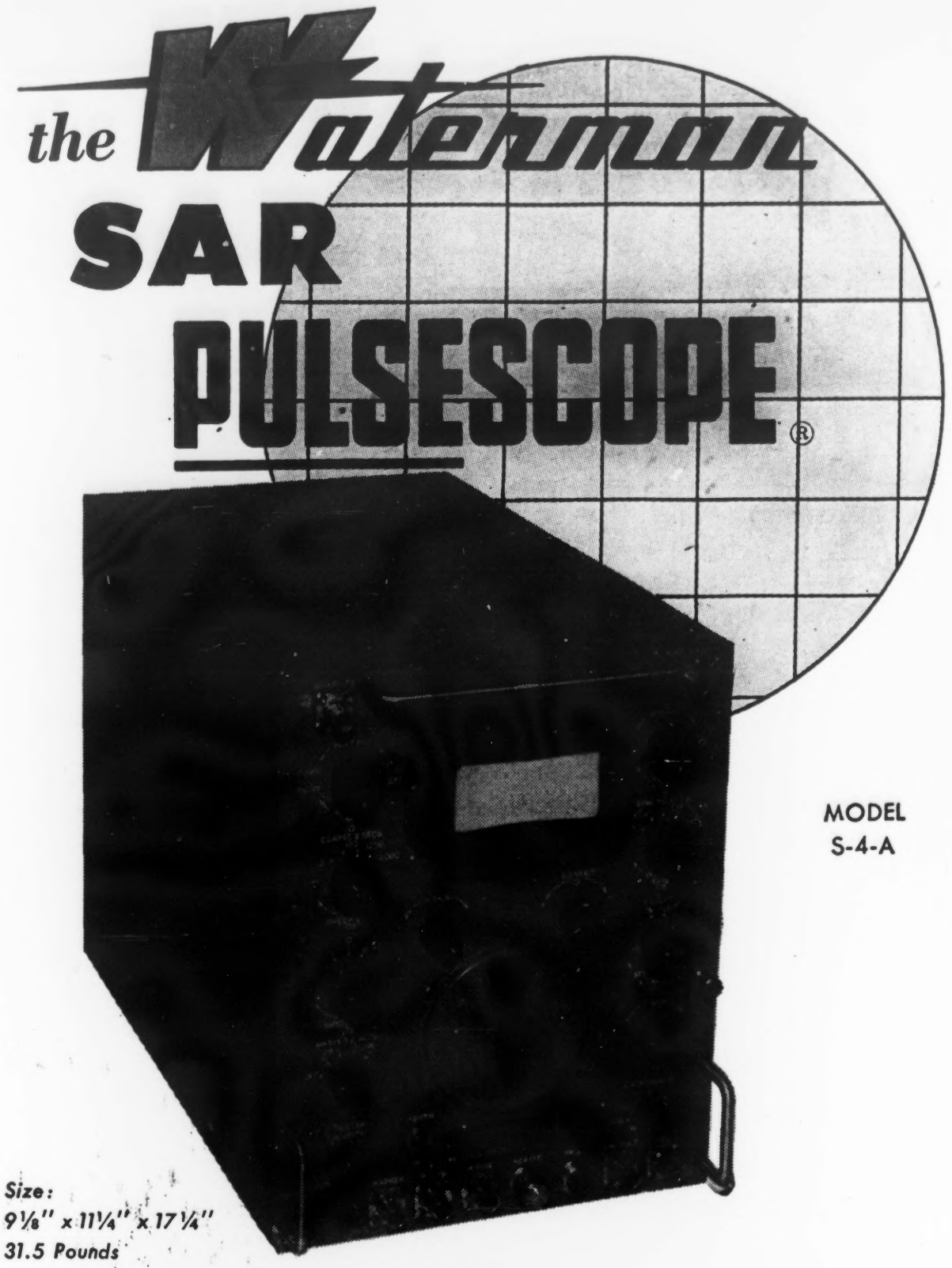
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WATERMAN PRODUCTS

Industry vs. the Military on the Manpower Market

(*Continued from page 76*)

* His program must offer training in an occupation which:

A. Is customarily learned in practical on-the-job training;

B. Requires 4,000 or more hours of work experience;

C. Is well known in industry;

D. Requires at least 144 hours of theoretical or technical instruction for each year of the course;

E. Must not be merely a part of an occupation normally learned through apprenticeship; and

F. Must develop the man's skill so that he may use it throughout industry rather than have it restricted to use by one employer.

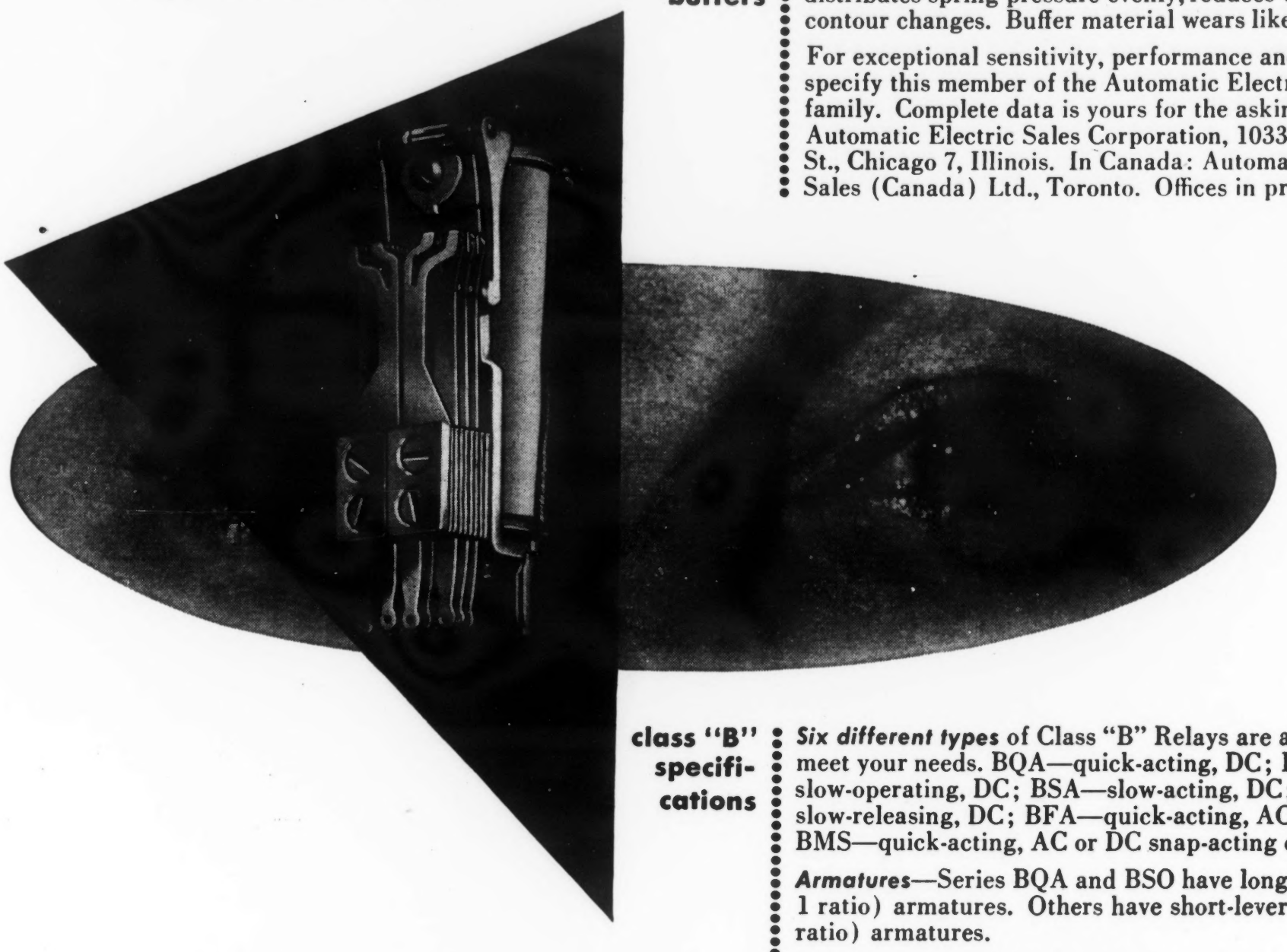
There are some other factors. Such a program must be sponsored and well-organized, actually have been operating for more than a year, and the reservist-apprentice must get a statement from his employer that the apprentice program in which he is enrolled meets the standards set forth above.

Also, a reservist who completes his period of apprentice training cannot transfer immediately to a job in critical industry and receive a further delay from mobilization. He must first complete a tour of active duty with his military component. This provision may be waived in exceptional cases.

These same regulations provide for other delay criteria. High school and college students may be entitled to such delays. The criteria governing the granting of such delays are very similar to the criteria presently in use by the Selective Service System. In addition to the consideration given students, certain government officials can be granted a delay; so can a man whose importance to the community welfare overshadows the needs of the military. Again, these reasons for delay will closely parallel the regulations of Selective Service.

In summary, the employer of today is faced with a handicap when he goes shopping on the manpower market. However, by conscientiously encouraging his reservist-employers to *lessen* their liability to mobilization he may avoid disruption of his productive capacity during periods of *partial* mobilization and smooth the conversion of his organization to war production during *full* mobilization.

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armature "sag off" eliminated Armature arms are extra-thick, designed to handle any spring load, even under constant, heavy use. There is no "sagging off" or any other such loss of stroke.

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class "B" specifications ***Six different types*** of Class "B" Relays are available to meet your needs. BQA—quick-acting, DC; BSO—slow-operating, DC; BSA—slow-acting, DC; BSR—slow-releasing, DC; BFA—quick-acting, AC; and BMS—quick-acting, AC or DC snap-acting contacts.

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Contacts—Normally twin. Load carrying capacity, 150 watts (maximum 3 amps.).

Contact spring capacity—Series BQA, BSO and BFA, 13 springs per pile-up. Series BSR and BSA, 6 or more springs per pile-up. Series BMS, 1 or 2 snap-action switches.

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For more detailed information, ask for Circular 1801.

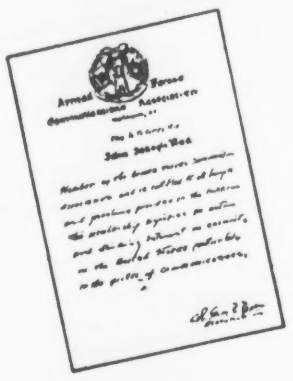
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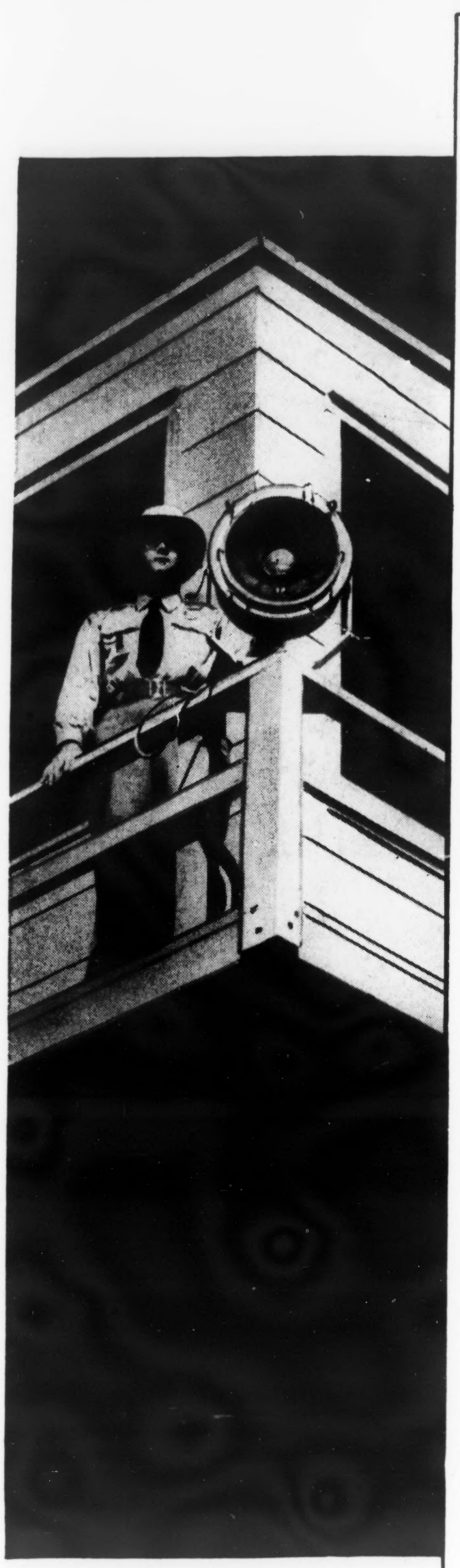
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